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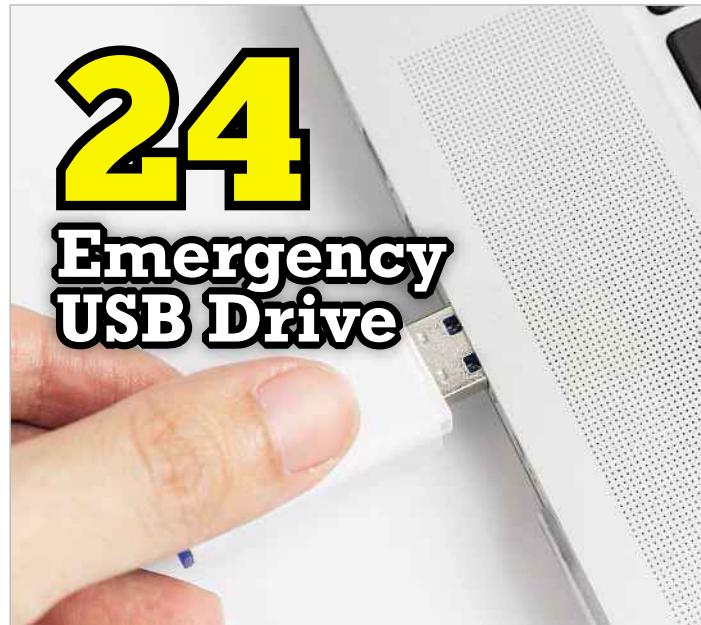
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2016 Hardware Preview **08**



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50 Graphics Cards Tested

A good graphics card can easily set you back several hundred pounds, but what if you're not after cutting-edge visuals and massive resolutions? In that case, you can get something for as little as £50, and still play a few modern games. David Hayward has been checking out six mid-range cards and seeing which is worth giving some space in your case

50 Graphics Cards Tested

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60 The £4 Computer

When the Raspberry Pi was released, it was a huge success, selling far more units than had been expected. As difficult as it was to live up to that reputation, the latest model, the Raspberry Pi Zero has done it, selling out in a matter of hours. Well, what do you expect for something that only costs £4?

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2016 Hardware Preview

David Crookes looks forward to the hardware goodies set to come our way over the next 12 months

It may be a sign of ageing but, boy, hasn't 2015 gone fast? It barely seems like yesterday when we were ushering 2014 away and yet here we are waving a big fat goodbye to 2015 and starting to roll out the red carpet for 2016. Normally, we would say the new year would be very welcome, only it doesn't appear as if it is going to start too well for our data. The Intel Security McAfee Labs Threats Predictions Report says cyber threats, attacks on hardware and firmware and the continued flogging of stolen information are going to be solid features of the next 12 months.

It also predicts that we're going to see a rise in ransomware and the targeting of wearables in order to open up the smartphones that manage them. On top of that, there is set to be a continued attack on exploits within cloud services and a strong possibility of rising threats to automobiles. Scary stuff, for sure.



For all of that, though – and for all of the talk of the coming year heralding the downfall of specialty hardware, with proponents saying it won't matter what is under the hood – there is still much to look forward to. As it stands, 2016 looks set to be another bumper year for new, innovative devices and so – as is usual for this time of year – we can start by looking at the innards that will surely be catching our attention as the months roll by.

In terms of chips, we're going to see the introduction of Intel's new entry-level PC processors in the middle of the year as the company looks set to capitalise on the demand for gaming notebooks and mini PCs. Based on the Atom core, the Apollo Lake processors will replace Braswell, the lowest-powered chips in Intel's lineup, and they will be 14 nanometer processors with Intel HD graphics. Able to support 4K displays and eMMC 5.0 solid state storage, they will be low-cost yet they will offer higher performance, with a choice of dual and quad-core CPUs.

At the higher end, there is also a chance, albeit an incredibly slim one, of seeing the first 10nm chips – code-named Cannonlake – shipping during 2016. We say slim because Bill Holt, executive vice president and general manager for Intel's Technology and Manufacturing group, expects them in 2017. While we're not holding our breath on that, we will get something to cheer.

66 The next year is set to see a battle of the graphics cards 99

For Kaby Lake, another 14nm architecture, is going to be released over the next 12 months. Intel CEO's Brian Krzanich says the new chips will "build upon the foundations of the Skylake micro-architecture but with key performance enhancements". It appears that this will mean the inclusion of support for 5K display output and more efficient use of power. Kaby Lake appears to also add native USB 3.1 support and have up to four cores as the default mainstream configuration.

The next year is set to see a battle of the graphics cards as well. Nvidia's new Pascal GPU will be released – with high bandwidth memory generation 2 (HBM2), produced on the 16nm FinFET process – and will feature 17 billion transistors, more than twice that of the Titan X. Meanwhile, AMD is going to bring out a new GPU, which is currently going by the codename Greenland, that also has HBM2. The latter will be AMD's next-gen flagships graphics card with a 14/16nm FinFET process and bandwidth of 1TB/s.



Watch Out For... Sky Q

It's not often that we get excited about a set-top box, especially in these days of streaming services such as Netflix and Amazon Instant Video. Sky Q did make us feel a bit tingly, though, primarily because it addresses a lot of problems with the existing Sky system that should have been sorted a fair while ago.

It looks like it will finally bring the Sky set-up to the cutting edge, allowing it to put some distance between itself and the major rival Virgin Media. The only problem we can foresee is price, with some pundits suggesting it will cost more than £100 each month. It may be Ultra HD ready, but that's still a price we'd baulk at.

Still, Sky Q is packed with features. It is going to allow users to watch live or recorded shows from the Sky box on another other television or tablet. It will also let people pause the viewing on one screen and pick up where they left off in another room. For many, though, the biggie will be the ability to record four channels while watching another – throw in the availability of the +1 channels and you should never miss any show again.

For so long, Virgin has had the advantage here, with its capacity for dual recording but Q looks set to blow it out of the water. Sky Q is also going to allow users to save recordings on a tablet and take them out-and-about. This is great for those constantly on the go: there have been too many occasions when we've been away from home and seeking to catch-up on saved shows only to feel disappointed that the Sky apps don't allow for it.

Those who have Sky Broadband will benefit from another major feature of Q: the ability for the Q boxes to become wi-fi hotspots, making for faster access. The boxes will connect over a home's electrical wiring to give a solid connection and it's a welcome bonus that would, we'd imagine, be necessary given Sky's plans for multiroom wi-fi viewing.

Less exciting is the proposal for the remote, though. We happen to think that the current Sky Remote is pretty well perfect as it is. It's a design classic of sorts, with the buttons in the right places and, given the time it's been around, incredibly familiarity.

To change to a new touchpad remote could be a gamble and one which overcomplicates a winning system but we'll reserve judgement on that when it comes. As it stands, Sky Q is going to bring a flavour of entertainment computing to the living room with music and Facebook photo streaming and access to YouTube. There will also be new apps for Android and iOS.



At the same time, Nvidia is continuing to work on a Geforce GTX 960 Ti graphics card as it looks to head off the threat of the Antigua-based Radeon R9 380X graphics card launched by AMD. It should be out around January 2016 and allow Nvidia to keep its hand in the market before its larger release later in the year. Both are developments that we'll be sure to keep a keen eye on over the coming months.

66 There are also going to be some exciting peripherals around in 2016 99

Game On!

Gaming will continue to drive the PC market to a large degree over the next year. Lenovo and Razer are joining forces to co-brand Razer Editions of Lenovo's Y series devices and the first prototype will be unveiled at the CES. According to a statement, "Lenovo will employ its system design and engineering expertise, while Razer will enhance the immersive experience for gamers. The deal should allow Razer, which is already a name in gaming circles, a wider reach – and the new computers will have some Razer features, including customisable Chroma lighting effects.

There are also going to be some exciting peripherals around in 2016, chief among them another bash at producing a new version of the humble mouse. The Tesseract controller was

Watch Out For... A Bite Of The Apple

It may have its detractors but it is still very difficult to ignore Apple, and you can bet everything you own that it will have some hardware announcements to make in 2016. Most of these, we suspect, will be updates to the existing line-up of products however. The most obvious addition will be the iPhone 7. Apple follows the yearly path of a new version and then a S-enhancement of that version. We've just had 6S, so it doesn't take a genius to work out what the next upgrade will be.

What it will contain is another matter entirely. A lot of the recent innovations have been on the software side, with iOS 9 becoming more open to developers but with the difference between the iPhone 6 and the iPhone 6S being slight. Apple will need to pay extra attention to the hardware this time or run the risk of people becoming disappointed in its flagship product.

We should, as is tradition, see a newly designed iPhone – albeit with the same screen sizes as now. We should also see smaller casings since the smart money is on the loss of the home button at long last. Force touch would be a better option and it would mean the larger iPhones would become more pocket-friendly.

At the same time, experts are also suggesting a switch from an LCD to AMOLED screen. Apple is believed to be prototyping the technology and it could easily slip it into this generation. The indications are that it may be something Apple works on for the iPhone 8/8S instead but again, Apple keeps its cards close to its chest and it has the capacity to surprise us.

So what else? Well there is a lot of talk of the phone being waterproof – it's not a killer feature for us but it would be welcome – and the internet has sparked with rumours that the 3.5mm headphone jack is to be ditched and replaced with a Lightning port connection. Perhaps Apple would want people to switch to wireless but this could lead to the expense of replacing a fair few cans. The killing of traditional headphones won't be music to many ears.

The other major hardware change we can predict is a new Apple Watch, which after a slow start (and the introduction of WatchOS 2) became a nifty bit of usable and useful kit. We've no way of knowing whether or not it will be finally divorced from the iPhone, but we're guessing that you'll still need to have one nearby.

That's unless Apple decides to use an enhanced, more efficient chip, the likes of which have been made possible this past year. Such a move would free up space for enhancements, although we would much rather see better battery life so that we can feel more confident when using it on a day-to-day basis than we are at present.

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on display at the Play Expo in Manchester in October and it was gaining a lot of attention. Billed as an immersive and revolutionary multi-axis gaming controller, it's due to be released next October and it works with any Windows-based PC.

With six-axis movement, gamers can configure it to emulate keypresses as well as mouse and joystick movements. The idea is that it can offer precise, sensitive controls and while it takes some getting used to – we spent a fair amount of time getting to grips with it – once it clicks in your brain, it becomes intuitive

66 Expect the Raspberry Pi Foundation to come up with more goodies 99

as your hands tilts the top of the mouse, your wrist moves the entire device and your fingers tap in tandem. The makers are looking to make it wireless and they are also seeking to add more programmable buttons.

Being released at around the same time (so long as the Tesseract is able to raise the £70,000 it is asking for on Kickstarter before the deadline of January 4th) is another mouse replacement called Gest, which is worn a bit like an exposed glove. It comes with a strap that wraps around the palm of your hand and four clips which are placed on the fingers. Once in place, as you move your digits the device's sensors work out the gestures you are trying to make and translates them to the action on the screen.

It has been made for intricate work such as operating Photoshop, so it has a low latency of 40 to 60 milliseconds but it also being earmarked for use with the augmented and virtual

reality devices coming to the market soon – such as Oculus Rift. Best of all it makes you look and feel as if you have just stepped out of *Minority Report*. If we're honest, we can't wait to get our hands on it. Literally.

Pi In The Sky?

We can also expect the guys and gals at the Raspberry Pi Foundation to come up with more goodies in 2016. It surprised everybody last month by unveiling the Raspberry Pi Zero – a £4 computer that was given away with thousands of copies of its official magazine, MagPi. More units are being made and it will become widely available in 2016, but we can also expect more innovations with the standard Pi – currently on its second model and likely to be on a third iteration before the coming year is out.

One thing we will definitely see is pi-topCEED, which promotes itself as the first \$99 Raspberry Pi desktop. It has smashed through the \$50,000 goal it set for itself on Indiegogo and it is being backed by the Raspberry Pi founder and CEO Eben Upton. Coming with a 13.3" LCD screen that can be wall mounted, it has space to fit a Pi and it is compatible with any USB keyboard and mouse. It also comes with the pi-topOS that includes Scratch, Libre Writer, Sonic Pi and Minecraft.

Taking The Tablets

There will be a fair few new tablets in 2016, as you'd imagine. As well as the expected new iPads – perhaps an enhanced iPad Pro and another iPad Air – there will be the HP Elite x2, which combines a notebook with a tablet and works with Windows 10 Pro. It includes a 5th Gen Intel Core M Processor with optional vPro. Users can make edits with the Wacom pen and there are two cameras for virtual meetings too.

Then we can expect to see many more Windows 10 tablets in 2016, with a great many of them hopefully unveiled at the CES in January. Samsung – which has replaced its mobile communications chief executive following a troubled year – is





also likely to be showing off a new Galaxy tablet, although whether they are full-on brand new devices rather than updates of previous versions remains to be seen. After all, some analysts say companies may be better holding back since the user base for tablets could well shrink next year. A study by ABI Research reckons the install base has peaked at 373 million.

"Phablets are an increasing percentage of smartphone shipments and are a mobile alternative to replacing a tablet," says ABI Research director Jeff Orr in a statement. Indeed, Huawei has unveiled its Mate 8 phablet, which will be released in the first quarter of 2016 and it will run Android Marshmallow. With a 6" display and running the Kirin 950 system on a chip, it includes a Mali T880 GPU and the Huawei i5 processor. There will also be a fingerprint sensor on the back along with a 16 megapixel camera.

Nokia will also return with a bang in 2016. It will release the C1 in the fourth quarter (it cannot release it earlier than that due to the terms of the Microsoft-Nokia acquisition deal), but it will have both Android and Windows phone versions and there will be two sizes – a 5" and a 5.5", with up to 3GB of RAM and 64GB of storage. The higher-end model will also have a 13MP rear camera.

Watch Out For... Another Life For Nintendo

It is a real shame that the Wii U has not fared as well as expected, leaving it lagging behind the PS4 and Xbox One in terms of sales just a generation after the Wii was such a runaway success. Metacritic data showed that 2015 was the worst year for Nintendo games for a decade, even though there have been some sterling efforts including *Yoshi's Wooly World*, *Splatoon* and *Super Mario Maker*.

Nintendo is not dwelling on the past, though. A replacement which is codenamed NX is expected to arrive in 2016 and the *Wall Street Journal* has reported that development kits are already being sent out. Information is almost drip-feeding its way through, but the suggestion is that it will stick to a traditional TV console while having a mobile component. Some are predicting we'll know for sure when it appears as early as the start of Q2 2016.

The Wii U suffered, in part, because it didn't advance too greatly on the original Wii. It also failed to get across the message that the Wii U was actually a new console – many people, initially at least, thought it was an upgrade. It was always going to be a struggle to keep the momentum building with what was, in effect, a true mainstream console that even non-gamers were picking up. Nintendo appears to realise that, while the Wii was unique innovation, it now has to make a clean break from that success story and try to tackle its competitors head-on.

Expect to see the use of advanced chips and maybe, just maybe, the return of cartridges. There was a patent in February that suggested a move away from optical drives. It would appeal to the die-hard Nintendo fans and be great in speeding up the loading of games, something that has gotten worse in recent times. If that's the case, then expect to see a new *Zelda* on cartridge and *Dragon Quest XI* – Square Enix is said to be earmarking that game for the NX.

Best new Christmas gadgets

Stuck for Christmas present ideas, or don't know what to ask for yourself? Then feast your eyes on these nine innovative gift ideas...



Scosche smartSTRIKE

www.mobilefun.co.uk
www.bubbleit.com
www.cpc.farnell.com
£19.99

Why carry two long and cumbersome cables around with you, when you can use a Scosche smartSTRIKE instead? This innovative two-in-one cable charges and syncs both Apple devices with Lightning connectors and Android devices with microUSB connectors. The slim barrel design allows you to slide the cable easily into any protective case, and its three-feet length gives you ample scope to keep using your device while it's charging.



Scosche strikeDRIVE EZTIP

www.mobilefun.co.uk
www.bubbleit.com
www.cpc.farnell.com
£19.99

If you've ever lost your patience while trying to plug a charger into your phone or tablet, you'll appreciate the strikeDRIVE EZTIP. With this Reversible Micro USB Connector, it doesn't matter which way up you insert the connector, because either way will see it fit securely into your device, saving you time and hassle, and preventing possible damage. The 12W, 2.4 Amp strikeDRIVE EZTIP connects to your car's power socket using a three-foot coiled cable, so it won't get tangled or get in your way.



Scosche magicMOUNT XL Tablet Headrest Mount

www.mobilefun.co.uk
www.bubbleit.com
www.cpc.farnell.com
£34.99

Rather than balancing your phone or tablet on your dashboard, get a Scosche magicMOUNT XL. Window lets you mount your mobile device any surface, so you can use it just as happily at home or at work, as you can in the car. Just slip the supplied MagicPlate behind the battery cover or case of your phone or tablet, and it locks to the stand using high-powered magnets, with no need for a cradle. You can then angle your device as required.



August DVB500 Smart TV Box

www.idaffodil.co.uk
£87.45

This stylish set-top box comes with a variety of popular apps pre-installed, including Netflix, BBC iPlayer, Facebook, YouTube and Skype, and you can install more from the Play store. You can also watch live Freeview channels in HD, record your favourite shows to a USB drive or SD card and view videos and play videos, music and photos using the built-in multimedia player. For endless entertainment from your sofa, stick the August DVB500 on your Christmas list.

Yamaha MusicCast Trio

<http://uk.yamaha.com/en/dealers>
£899.95

Enjoy your favourite songs in every room in your home at the touch of a button using Yamaha's brilliant new MusicCast system. This lets you play music from your PC, NAS drive or mobile device, and from streaming services such as Spotify and internet radio on any MusicCast device, and either listen to the same song or different tracks throughout your home. It's controlled via an easy-to-use Android or iOS app, streams over Wi-Fi and Bluetooth and is compatible with a wide range of audio formats.



Elgato Aevea

www.elgato.com/avea
From £39.95

Don't suffer winter lights that are too bright or too dim – get perfect lighting throughout the day with Aevea. This dynamic mood light is controlled using your smartphone, iPad or Apple Watch, allowing you to transform the ambience of a room while lifting no more than a finger. Aevea can cycle through different colour combinations using one of its pre-defined light scenes and includes an option to wake you up as gently as possible. The battery-powered, wirelessly charged Aevea Flare illuminates the inside and outside of your home for more than eight hours on a single charge.



August MS515 Bluetooth Stereo Speaker

www.idaffodil.co.uk
£32.45

This portable Bluetooth stereo speaker set is the perfect gift for audiophiles, combining a unique design, a 10W output and an impressive 15 hours of battery life. The two speakers pair with your phone, tablet, smart TV or laptop, and non-Bluetooth devices can be connected through the 3.5in audio-in socket. The superb sound can be boosted further using EQ apps for Android and iOS, and you can adjust the volume and skip through tracks using your phone or tablet.



Scosche magicMOUNT XL Tablet Headrest Mount

www.mobilefun.co.uk
www.bubbleit.com
www.cpc.farnell.com
£34.99

It's not just drivers who want to use their tablets in the car, but back-seat passengers, too. Scosche's magicMOUNT XL Tablet Headrest Mount uses powerful magnets to hold your device securely in place, once you've inserted a MagicPlate into its case. The mount comes with both large and small MagicPlates, which means you can use it with any size of tablet or phablet, and lets you attach your device in landscape or portrait mode, and any angle in-between.



iStorage datAshur Pro

istorage-uk.com
From £69

To prevent anyone from accessing your private data, keep it stored on an iStorage datAshur Pro. Described as the world's most secure USB flash drive, it protects your files using a 7-15 character PIN code and military-grade AES 256-bit hardware encryption. The device locks automatically when you disconnect it from a USB port, includes a rechargeable battery and is dust- and water-resistant. It's available in capacities of 8GB to 64GB, and requires no software or drivers.



Surprise, Surprise

As always, though, we should see a fair number of surprises. There is already talk, for instance, of Google Glass coming back. The technology seemed to show so much promise in 2014 before it was axed at the start of 2015, but CNBC reports that a next-gen Glass that looks like a monocle is set to replace it. The hope is that, by designing something that doesn't make people look idiots, there will be a greater take-up.

We're also going to see an unexpected entrant in the smartwatch space: Swatch. It has partnered with Visa to bring contactless payments to the Bellamy watch in a bid to compete with Apple Pay. Other than that, it will tell the time but it could well be that lots of other 'traditional' watch manufacturers follow Swatch's lead and add similar functionality.

Finally, 2016 may be the year that Apple takes to the stage with an augmented reality projector. It has been granted a patent for an adaptive projector that is able to project images onto surfaces, allowing for instance, someone to read a blank book with the text overlaid. In the meantime, we can "make do" with the very impressive looking Microsoft Hololens. The development edition is going to be released in the first quarter of 2016 and we can't wait to see what developers will do with it.

For those unaware, Hololens is a cordless, smart-glasses headset which allows for augmented reality applications. It overlays digital images onto the real world. Consumer units are unlikely to be released in 2016, but the momentum could gather pace pretty rapidly. We're more likely to see it in 2017 but, as we said at the start, the years go fast so perhaps it won't feel too far away. **mm**

Watch Out For... Sony PlayStation VR

You may remember that back in the early 1990s, VR was emerging as a very big thing but it quickly died a death, in the consumer market at least.

It has been making a major comeback, with Oculus Rift impressing gamers by providing advanced visuals and realism, and Google Cardboard proving to be a solid introduction to the VR arena that requires only a cheap cardboard kit, a suitable mobile phone and some apps to run on it.

PlayStation VR's headset is Sony's toe in the water. It has a full HD 1920x1080, 5.7" display with a 100° field of vision. It also has a 120Hz refresh rate, nine head-tracking LEDs and support from the PlayStation 4 – the console will need to be connected to VR in order for the headset to work, and it will also make use of the PlayStation Camera for motion tracking. As if to show that Sony isn't wasteful, it will also utilise the Sony Move controllers, which have been around since the Playstation 3's prime, back in 2010.

At the time of writing, there was still no specific price nor a firm release date but we can expect to see it before June. We figure it will cost around the £300 mark which would not be so bad for such an advanced piece of kit. Thankfully, those who buy it should be able to have a lot of fun since it's already set to be supported by a whole raft of games.



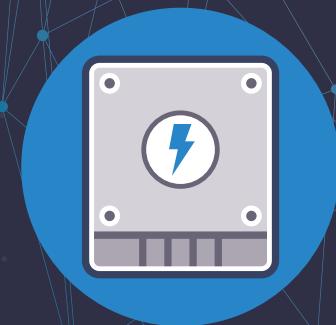


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Is Windows 10 Having A Wobble?

Microsoft's latest operating system came out in July. Sarah Dobbs looks at how hard Microsoft is willing to push it onto users...

Upgraded to Windows 10 yet? Microsoft's newest operating system is meant to be great, ditching the features of Windows 8 that people didn't like and introducing all kinds of new stuff; it's meant to be the operating system that'll stick around for years, work on every device with every imaginable app, and finally persuade those slow adopters to ditch Windows XP at long last.

It got off to a pretty flying start too. Within four weeks of its launch on 10th July, Microsoft's stats showed that it had been installed on 75 million PCs and tablets. To put that in context, it's about double the number of computers that had installed Windows 8 within a month of its release, and nearly four times as many as had installed Windows Vista in its first month.

While that might've been cause to crack out the champagne at Redmond back in August, since then things have slowed down a bit. Analysis of desktop internet usage by both NetApplications and StatCounter showed a slowing down in increased market share for the new operating system: after its first month, Windows 10 accounted for around 5% of devices recorded online, but by the end of September it had only crept up another 1.5% or so (numbers vary slightly depending on which source you look at, but both show a tailing off). At the time of writing, estimates put its market share at about 9% – with Windows 8.1 sitting at 13%, Windows XP at 9%, and Windows 7 at a massive 50%.

Microsoft has said its goal is to get Windows 10 onto a billion devices by 2018; while there's still plenty of time left, that goal is still quite a way off. So, how can Satya Nadella and co convince more people to switch – and, if you're one of the people who haven't upgraded your computer yet, should you?

Free Upgrades

The initial rush of upgrades is fairly easy to explain. There's the thrill of the new, for one thing; any new (and well-promoted) product is likely to do brisk business in its first couple of weeks. Then there's the fact that Windows 8 was pretty widely disliked – with its Metro interface that seemed to confuse and frustrate most people. Anyone using an operating system they hated is likely to want to upgrade as soon as humanly possible.

The real reason Windows 10 did so well in its first couple of weeks, though, was that Microsoft gave it away for free; not just bundled with new PCs, but to existing users. Anyone who was already running Windows 7 or 8.1 on a device that was compatible with Windows 10 was entitled to a completely free upgrade. If you're included in that group, you're probably rolling your eyes, because Windows 8 and 8.1 users weren't just entitled to free Windows 10 upgrades. They were aggressively badgered into upgrading. A Windows 10 icon appeared in their taskbars, and wouldn't go away. Instead, it regularly popped up a reminder that Windows 10 is free and available, and all you'd have to do was click to get started...

So yeah – it's no surprise that a lot of people took Microsoft up on their offer. There's no way to know how many of those people would've upgraded to the new version anyway, of course, but looking at how much faster people adopted Windows 10 compared to previous systems, it seemed like it was a pretty good ploy on Microsoft's part (except that it didn't make them any money, of course), and a great way to get the Windows brand back on its feet after recent stumbles.

However, it's been a couple of months now, so most people who are planning to take Microsoft up on its offer of a free upgrade have probably already done it. Now, the hard work of persuading everyone else starts.

Marketing

Microsoft has always had a bit of an image problem. Unlike Apple, which has positioned itself as the super-cool company that makes products to make their customers cool too, Microsoft doesn't really have much of an identity. For those of us who've grown up using it, it's just sort of there. It's familiar enough that for Windows users – and that's around 90% of all desktop/laptop users – don't really think about it in terms of whether they like it or not. We just use it.

That's a problem for Microsoft's marketing department, though, because you can't sell someone something new if they barely even think about the thing they're already using. Why would you change something that works well enough? In that department, if in no other, Windows 8 might be a bit of a blessing, since it at least gave people something to dislike, and thus motivation to move on. At the same time, though, perceived failures like Vista and Windows 8 make people wary of signing up for a new operating system that might turn out to be equally unloved.

What Microsoft needs to do is convince users that Windows 10 is a step forward, and also that it's somehow aspirational; something that will make their lives better. The current advertising campaign is fairly convincing on that front. It focuses on children, and the ways in which technology will change or improve their lives, and apart from the slightly questionable way one of the ads positions Paloma Faith alongside Billie Holiday as important cultural figures, it seems like a pretty solid campaign. No-one's going to argue with the idea that kids are the future, so positioning the Microsoft brand as the company that's going to accompany these kids on their journey to making the world a better place seems smart. Plus there's plenty of scope for variations on the theme, without getting too bogged down in backstory in the way that some over-ambitious ad campaigns sometimes do.

“ Microsoft doesn't really have much of an identity. For those of us who've grown up using it, it's just sort of there ”





More Free Stuff

A few nice TV spots probably won't be enough to sell another 900,000,000-odd copies of Windows 10, though. Microsoft is going to have to try a bit harder than that, and also come up with ways of convincing people more interested in technology than children that they too, should make the switch.

That harder sell has already started. First up, Microsoft launched a special offer in the US that saw over 1,000 movies, games, apps, and songs available for just \$0.10 to Windows 10 users. It was a limited time only offer, but Microsoft figured cheap access to the likes of *Angry Birds Star Wars* and *Jurassic World* for mere pennies would be enough to convince some of those people who'd been ignoring their 'free Windows 10 upgrade!' popup to finally take the plunge.

Next, Microsoft launched AppComparison for Android devices. Install that on your phone or tablet and it'll take stock of all the other apps you've got installed and let you know which ones are also available on Windows 10 devices – as well as suggesting alternatives for any that aren't available. It's supposed to persuade Android users who worry that there just aren't as many apps available for Windows devices, though quite how many Android users there are who are dithering over getting a Windows phone is unclear.

So far it's not been a total success because, as it turns out, there are quite a few apps that really aren't available for Windows yet, and the alternatives aren't always particularly appropriate. Still, if Microsoft gets its way, that's a situation that'll improve over the coming months.

Pushiness

From the number of times I've already mentioned the upgrade pop-ups, you might've guessed that I'm one of those awkward Windows 8.1 users who hasn't yet bitten the bullet and moved over to Windows 10. If you're like me, you might want to know

that Microsoft is about to get really pushy. For starters, even if you haven't yet accepted the upgrade, you might find that Windows 10 files have already been downloaded onto your PC. If your computer is set to download automatically from Windows Update, Microsoft will have 'helped' you by pre-loading some of the software you'll need onto your computer, so it's ready to spring into action the moment you decide to upgrade.

“Even if you haven’t yet accepted the upgrade, you might find that files have already been downloaded”

That bit of sneakiness came out in September, though the push began in July. When questioned about it, a Microsoft spokesperson said it was totally normal practice – although some users who didn't fancy handing over 6GB of space on their PC for an upgrade they hadn't yet agreed to, or those who hit their ISP's data cap as a result of the massive download, weren't best pleased about it.

Next year, the Windows 10 upgrade will go from being an optional extra to a 'Recommended Update'. At that point, if you have recommended updates activated in your Windows settings – the safest option for the majority of users – you won't be asked to update to Windows 10, it'll just happen. Users will still need to approve the installation, so you're not going to suddenly switch on your computer and discover everything's changed, but it's going to download itself automatically. Basically, Microsoft won't be asking you to update, it'll be telling you.

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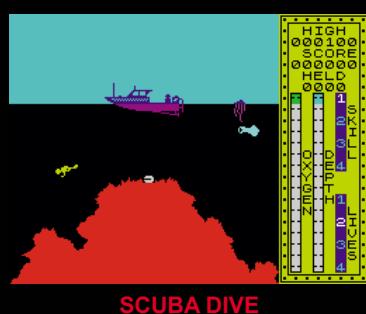
If you already have your phone/tablet/pc connected TV (with Apple® TV / Google® Chromecast® / other) you can play the games and code in Sinclair BASIC on the big screen.

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To Upgrade Or Not To Upgrade?

Whether or not that's a problem probably depends on how stubborn you are. If your immediate impulse is to reject the upgrade, you've probably already turned off automatic updates in Windows Update – and you're probably tech savvy enough to make that decision for yourself. For people who don't think about that kind of stuff, though, is it a problem?

“Windows 10 has been welcomed as a pretty good OS that kept enough of the feel of Windows 7 to be comfortable for long-term users”

Windows 10 has, generally, been pretty well received. While Windows 8 racked up a lot of negative reviews, Windows 10 has been welcomed as a pretty good OS that kept enough of the feel of Windows 7 to be comfortable for long-term users while introducing some decent new features. Being the newest operating system also means it's Microsoft's baby, and will be getting plenty of attention – in the form of patches, updates, and bug fixes – over the next few years. For anyone who wants to just use their computer without having to worry about how it's running, it should be a secure, sensible update. For Windows 7 users, there'll be a bit of a learning curve at first, but nowhere near as much of a shock as there was in Windows 8. And for Windows 8.1 users, well, we've not really had long to get attached to it, have we?

Ultimately, maybe we should just accept that, sooner or later, if we choose to use Windows, that's going to mean Windows 10. Microsoft is clearly going to push as hard as it can to get it onto our computers, and there doesn't seem much point in resisting. While we've only got a couple of months' worth of data to go on at the moment, a lot of people have already updated, and while the initial rush has worn off, it's still converting users of older operating systems at a decent enough rate – when Threshold 2, the first update to Windows 10, was released, there was a significant spike in upgrades, and that seems likely to happen every time there's an update or another reason for media coverage.

A Windows Timeline

Lost track of when you previously upgraded and to what? Here's a short history of Windows operating systems to date...

1985 – Windows 1.0

A sort of extension to MS DOS that was meant to compete with Apple's Lisa, but wasn't well liked

1987 – Windows 2.0

The most significant thing here was probably the introduction of overlapping windows, a feature all of us would learn to abuse over the years

1990 – Windows 3.0

The one where Windows caught on, it came with apps like Notepad and Paintbrush built in

1992 – Windows 3.1

Codenamed Janus, this update brought in TrueType fonts

1995 – Windows 95

Windows 95 introduced the Start button and taskbar, and is probably the first iteration that's still recognisable today.

1998 – Windows 98

Internet-related applications started to be bundled with Windows from 98 onwards – it came with Internet Explorer, Outlook Express, NetMeeting, and other web-focused programs

2000 – Windows ME

The last of the DOS-based incarnations of Windows, ME might be the least popular version of Windows ever

2001 – Windows XP

This is the one that just won't die. XP was well-loved, despite the fact that it was the first version of Windows to introduce Windows Product Activation

2006 – Windows Vista

As hated as XP was loved. Vista came with User Account Control, a feature that was meant to beef up security, but actually just annoyed everyone

2009 – Windows 7

Another popular one, 7 was speedy and streamlined where Vista was bloated, and also had built-in support for touchscreens

2012 – Windows 8

Microsoft tried to convince everyone tiles were better than a Start button, and failed

2013 – Windows 8.1

An antidote to many of the problems with 8, 8.1 reintroduced the Start button, but kept the Metro interface and Charms

2015 – Windows 10

The one we've been talking about. It ditches Charms, brings back the Start menu, tweaks the tiles into something quite different, and adds in the ability to run apps from the desktop. Will it be regarded as affectionately as XP in a decade's time? We'll have to wait and see

If you are still holding out, it's worth bearing in mind that the one-year period for Windows 7 and 8.1 users to upgrade for free ends next July. After that, when you decide to make the leap, you're going to have to pay for it. Maybe we should all just give in, do what Microsoft wants, and upgrade now? **mm**

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How To Build An Emergency USB

When Windows won't work and your PC won't boot, what do you do? You use an emergency boot disk, that's what

There are few moments in your time using a PC that are as panic-inducing as being unable to boot into Windows. The thought that all your data, programs and other content is potentially lost because you can't get to it can be enough to send you into a cold sweat, and understandably so.

If you can't get to Windows, how on earth are you supposed to fix your PC and get your data back? Is there anything you can do, or are you stuck? No, you're not stuck and there is an answer; it just needs a little forward planning, a USB drive and some useful software. This answer is to create an emergency USB drive.

PC First Aid

Also called a boot or recovery disk, an emergency USB is a very useful tool to have if you're a PC owner, because it'll allow you to boot your PC to a usable state in the majority of situations (barring, of course, physical hardware damage). Using one, you can opt to boot your PC



▲ The humble USB disk can be an invaluable tool in emergencies

```
D:\>Program Files (x86)\Windows Kits\8.0\Assessment and Deployment Kit\Deployment Tools>makeWinPEMedia /UDF F:\WinPE_x86 h:
WARNING: ALL DATA ON DISK DRIVE h: WILL BE LOST!
Formatting h:...
Setting the boot code on h:...
Copying Files to h:...
Success

D:\>Program Files (x86)\Windows Kits\8.0\Assessment and Deployment Kit\Deployment Tools>
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▲ A simple command can create a Windows ADK boot environment

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einstallation Environment\and4\Media\hu-hu\bootmgr.efi.mui
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D:\>Program Files (x86)\Windows Kits\8.0\Assessment and Deployment Kit\Windows Pr
einstallation Environment\and4\Media\zh-cn\bootmgr.efi.mui
D:\>Program Files (x86)\Windows Kits\8.0\Assessment and Deployment Kit\Windows Pr
einstallation Environment\and4\Media\zh-tw\bootmgr.efi.mui
180 File(s) copied.
 1 file(s) copied.
 1 file(s) copied.
 1 file(s) copied.

Success

P:>\WinPE_x86>
```

▲ Once created, the ADK boot files need to be copied over to the USB drive

from the software or OS on the disk, instead of the PC's own internal volume. This allows you to bypass any problems that prevent your system from booting as normal, and you can usually fix any problems or at the very least, gain access to your data, meaning a format won't be as nightmarish as it would be if you lost it all. This ability simply can't be overstated, and having one around if you encounter such PC problems is something you'll be very thankful for.

Sadly, a lot of people don't use them, with a large portion simply being unaware of them or unfamiliar with the process of creating one. Some simply see a USB recovery disk, with its ability to bypass Windows and boot into a special operating system or, even worse, a DOS prompt, daunting. Surely that's an advanced tool for engineers, they think, and one that they couldn't possibly use.

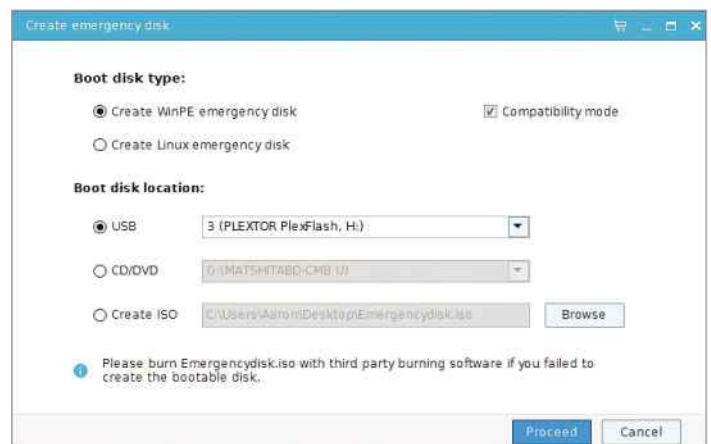
This is incorrect and although most professionals do, indeed, make extensive use of these, there's nothing you should worry about, and they're just as approachable for the home user as they are to an expert in charge of a company's network. All you need is the know-how, which we'll give you on these pages.

What You'll Need

The first, glaring item you'll need and the only part that could cost money if you don't already have one handy is a USB drive. A recovery



▲ When EaseUS TODO Backup is open, click Tools and select the emergency disk creation option



▲ Choose the WinPE boot disk and select your USB device

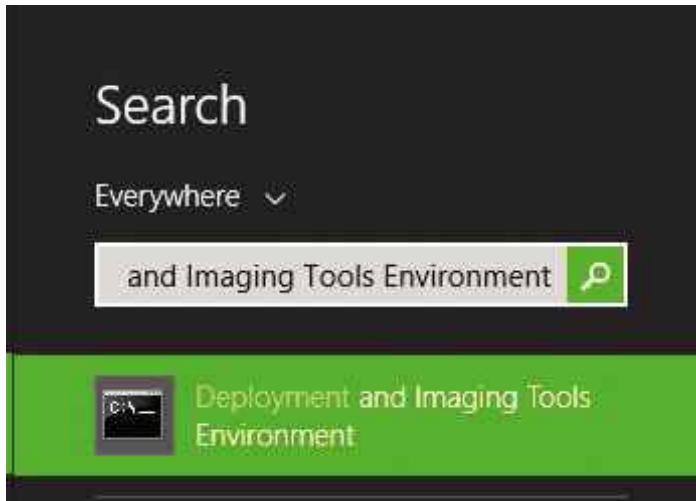


▲ The software will then create the boot disk for you automatically

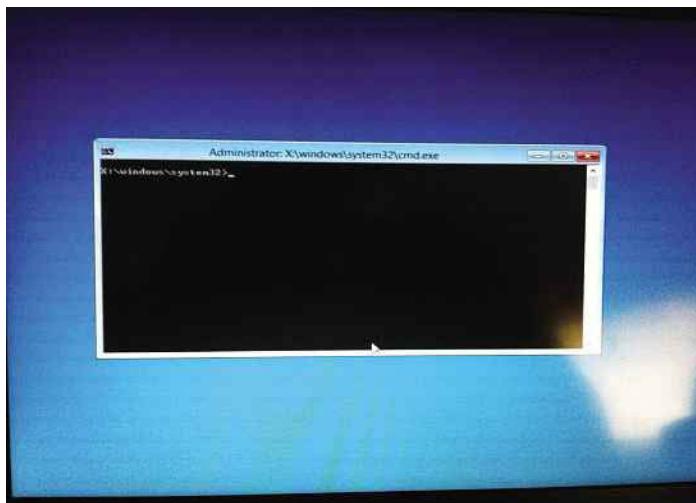
drive like this doesn't need to be large, as you'll only be using simple tools on it, so a cheap, 1GB or 2GB model should be fine for the most part. In fact, even a 512MB model will probably do for most boot disks.

However, it's worth noting that a larger USB drive could be useful if you need to copy a lot of data off a troubled system. With such a drive, you'll find it easy to copy data without having to utilise extra external storage or network connectivity. That said, as long as the USB boot disk lets you get the PC up and running, this may not be a problem.

As well as the USB drive, you'll need the correct software, and this is where your choices vary wildly. There are many different



▲ To run the Deployment and Imaging Tools, simply search for it



▲ Microsoft's ADK boot disk is bare bones, with a command prompt interface

66 If you prefer your OS a little more free and open, you may instead go for a Linux option 99

approaches you can take here, and there are all sorts of boot disk solutions. The best are usually .iso images that are copied to the USB device to create bootable media. These often use a special Linux-based OS, but it's not exclusive.

One of the favourite options here is WinPE (Windows Preinstallation Environment, also known as Windows PE). This is one that's often used by network admins and technicians, and it's a very powerful tool that allows the recovery of problem systems. And because it's developed by Microsoft, it's perfect for Windows owners.

Alternatively, if you prefer your OS a little more free and open, you may instead go for a Linux option. There are many of these, and we'll look at some of them elsewhere, in the 'Linux To The Rescue' boxout.

For now, we'll stick with the Windows option and focus on the creation of a WinPE recovery tool. This can be created in multiple ways, with one option being the method as described by Microsoft on

the official site, where you can also get WinPE. You'll find this at bit.ly/1I0FCb4. We'll also cover an easier method, so if you'd rather just have another program do this for you, skip ahead to 'EaseUS As Pie'.

Before you actually create the boot disk, you'll first need to install The Windows ADK (Assessment and Deployment Kit). This kit includes the tools needed to create the boot disk, so install and download this. It's free and you can grab it from bit.ly/1jaxsRD. The installation will be around 5GB, and it takes a while, so grab a coffee and sit back.

Once this is done, you'll be able to use the Deployment and Imaging Tools Environment from the Windows Command Prompt. You'll need to do this as a system admin, so ensure your account has the relevant permissions, and then search for 'Deployment and Imaging Tools Environment' and run it. This will open the special command prompt.

You'll need to type in the correct command to create the PC files you need for the boot disk. To do this, type the following, using the required parameter of x86, amd64 or arm. In the example below,

Linux To The Rescue

We've looked at emergency USB boot disks, including the use of a portable version of Windows, but that's not the only OS you can call on in an emergency. Linux has long been the staple of many mobile OS solutions and for good reason: it works very well indeed and it's often totally free, unlike Windows, which requires a licence for each installation.

Many Linux distros support USB booting, so the available selection is fairly wide. However, some are better than others when it comes to functioning as an emergency rescue solution, and here are three of the best versions to consider if you want to use Linux as your saviour in times of need. These are not operating systems per se, but dedicated emergency tools. For actual portable versions of Linux, look at the boxout 'Linux A Go-go'.

First we have the appropriately named Ultimate Boot CD. Although it's designed for CD use, it can be mounted to a USB, and it's a full range of diagnostic tools designed to analyse both Windows and Linux systems. The tools on offer are more based on diagnostics than actual recovery, but as any engineer will tell you, half of the battle when fixing a PC is finding out what's actually wrong, and that's why this is such a highly recommended option. There's also a special, Windows-centric version available. Get it from www.ubcd4win.org.

Next we have Hiren's BootCD. This is one of the most famous boot disks and one that can be found in many IT support engineers' collection. It's a fully featured tool kit that's designed for fixing Windows systems and includes anti-virus and anti-malware, rootkit detection, format and partition tools, backup functions and much more. It's a superb collection of software that presents just about anything you could need to bring a system back from the edge of death. Grab it at www.hiren.info.

Finally, we have Falconfour's Ultimate Boot CD. Users debate which is the best overall boot rescue tool between this and Hiren's, and Falconfour's is often placed on a higher pedestal. Like Hiren's, it features a large range of software and tools, and faithful users would argue this is the only emergency boot solution you'll ever need. Given the plethora of tools and functions on offer, it's hard to argue. You can grab it from bit.ly/1QZjb8e.



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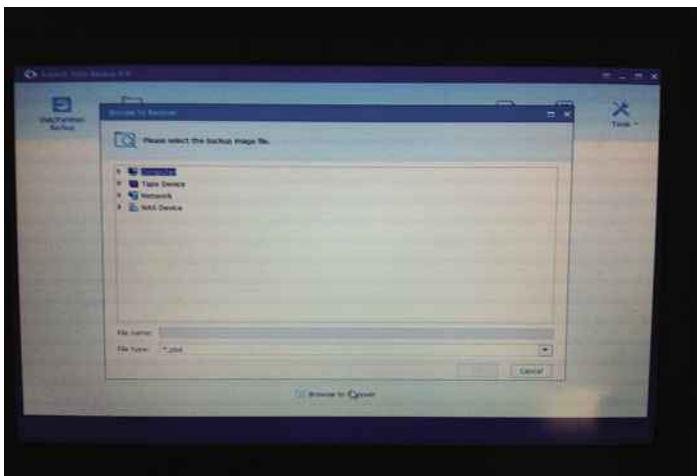
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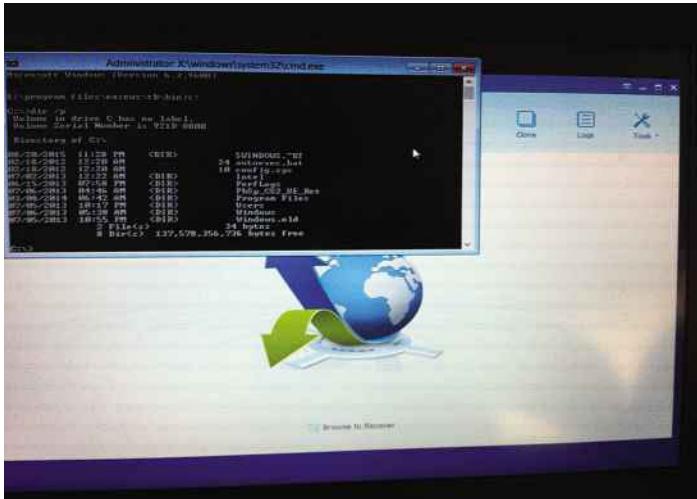
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▲ EaseUS TODO's backup tool is included in the boot disk



▲ Although it has a full GUI, EaseUS has a command prompt

we're using an x86 system. You can change the location to copy the files to another drive if you wish. We've used X only as an example.

copye amd64 X:\WinPE_x86

Next, you simply need to install the Windows PE environment to the boot device, in this case your ready and waiting USB, which should be plugged in. To do this, type the following, using the corresponding system parameter as above and replacing X with your source location (where you specified in the above command) and Z with your USB's drive letter. Be aware, this also formats the USB drive, so ensure you copy any existing files you may still need from it before you do this.

MakeWinPEMedia /UDF X:\WinPE_x86_Z:

This will create the actual boot disk for you. Once you have this, you can then boot up from it, which we'll cover later on. First, how about that easier method of creating a boot disk?

EaseUS As Pie

A very easy way to create a USB boot disk without the need to download and install Microsoft's tools manually is to use EaseUS Todo Backup. This comes in a totally free version, which also includes the ability to create an emergency boot disk using WinPE.

All you need to do is go to bit.ly/1ibSNYo and download the free version of the software. Once installed, there's an option within Tools

Linux A Go-go

A fully functional portable OS can be a big help, and you don't always need specialised software or rescue tools if you can boot up using an actual OS. We've looked at Windows, but there's also Linux to consider. Here are a couple of the best options for carrying Linux with you on a USB.

First up is ever-present crowd pleaser Ubuntu. This is one of the most popular flavours of Linux, full-stop, mainly due to its friendly UI and powerful features. Having this on the go is very useful, and you can use the operating system's built-in USB drive creation tool to build one very easily. Find out more at www.ubuntu.com.

Puppy Linux is one of the smaller portable distros you can find, and it can be easily crammed onto a CD or USB. The interface is very simplistic, but it gives you all the tools you should need if you're on the go, including office tools, a browser, email and chat. You can download it from puppylinux.com.

Few names are as fitting as Damn Small Linux. This was designed from the start to cram Linux into as small a package as possible for use in business card CDs, and that's just what this does. It manages to fit the whole OS, along with some very useful tools, into a 50MB installation. This means even very old USB drives can handle this with no problems, so you may not even need to buy a new one. It features tools like Firefox, VNC, web server and more. Very nifty. Get it from www.damnsmalllinux.org.



▲ *Puppy Linux is a tiny distro of Linux designed for portable use*

for creating emergency boot disks. Select this, and on the next screen select the option to create a WinPE emergency disk. Select your USB drive from the boot locations, and then click proceed. You can leave compatibility mode selected.

The software will begin to get the required files ready, and you'll be prompted to format the device. Say yes (again, ensuring you clear off any required data so you don't lose it) and continue. Eventually, the software will finish creating the drive for you, and you'll get a message saying WinPE's .iso has been successfully exported. This will create an EaseUS-branded boot disk, with a similar user interface. It also fully supports UEFI.

Booting Up

You now have a USB boot disk that's ready to go when the need arises. Whichever method you decide to go for, you'll fire them up in the same way, by booting from your USB drive from your system's boot menu. You may need to pick the UEFI boot option to actually use the

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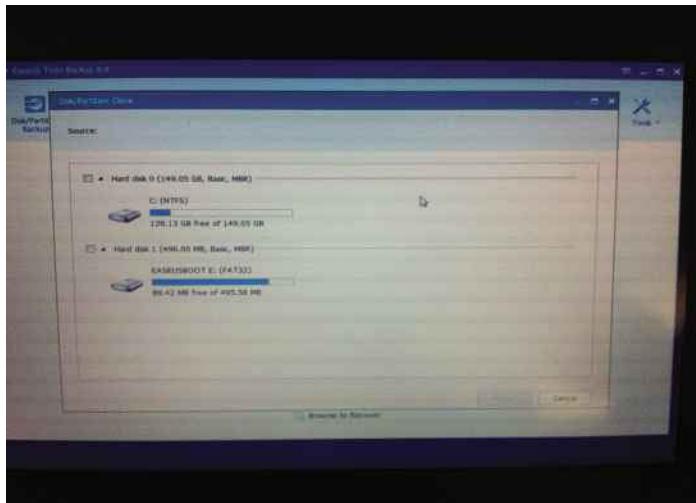
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▲ You can partition drives using EaseUS TODO's boot disk



▲ The various tools are all found in an easy-to-use menu system

drive. If all has gone well, you should see the Windows logo, and the boot environment will be launched.

For the two methods we've mentioned here, what follows will be very different. The Windows ADK version will boot up to a simple command prompt. From here you can use a wide range of tools via the prompt to diagnose and repair a system or at the very least get data back. It's a very complex environment, packed with all sorts of commands, tools and arguments to be typed in. You can find much more information at [bit.ly/1PQyuPI](http://tinyurl.com/1PQyuPI). As you'll see, it's a boot disk that's not really for the casual user, and to get the most out of it you'll need to have knowledge of DOS and command prompts. If this isn't you, you'll definitely want to use the EaseUS option.

The EaseUS TODO Backup-created boot disk doesn't simply boot to an empty command prompt. Instead it boots to a GUI that has a range of easy-to-access features, all of which are on the Windows ADK version; they're just easier to make use of here. As well as this and a command prompt if you prefer that, the EaseUS versions also has its own backup and cloning tools, making it very useful for both inexperienced and expert users. This is the option we'd recommend for most users and the one that'll make your time diagnosing and fixing problems much easier.

Portable Apps

There's a lot more to emergency USB drives than boot disks. Although these bootable volumes are obviously very useful when your PC is sick, you can also turn a USB into a veritable Swiss army knife that can be an

Life-saving USB

We often use hyperbolic terms when talking about cool gadgets and technology, saying things like 'This rescue software is a real life-saver.' For computer users who could lose a lot of sensitive data, this may be very true in terms of the problems it could cause, but it rarely becomes an actual matter of life and death. However, emergency USB drives could actually be life-savers – that is, if you create one for actual, real-world emergencies, such as medical or travel situations.

With our interconnected world that's run by computer, it's now become increasingly more popular to carry a special, emergency USB with you at all times, especially if you have a medical condition or you travel around the world.

Just as people who have severe allergies or conditions like diabetes or epilepsy carry special identification or necklaces so medical professionals can help them even if they're unconscious, others do the same with a USB disk, and unlike other means of identification, a USB drive can contain a lot more information.

Using this method, you can place all sorts of important information on the USB drive, including name, address, emergency contacts, medical information, insurance and much more. You can even scan and store copies of your identification documents, passport, visas and all sorts of other important documents you may need in an emergency.

Some users also use encryption software to store other useful data, such as credit card information, passwords and other sensitive information. Basically, any data that can help you out in an emergency, whether you're conscious or not. As long as the drive is easily found, it could well be a true life-saver.

Aside from the information you include, the other important feature of any such USB is durability. You'll want a good quality and rugged USB drive that can handle the odd knock or even water-based accident. A popular option is Verbatim's Tough 'n' Tiny. These USB disks, as the name suggests, are very small, durable and can even be worn around the neck, perfect for this use. They're also cheap, with a 32GB model costing around £10.

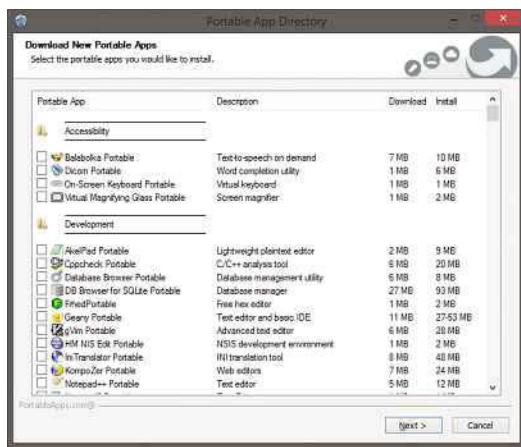
A very important thing to bear in mind when creating a drive is language. You could ensure you use a translation service to store copies of your information in various languages on the drive, which would make sure it could be read.



▲ Verbatim's Tough 'n' Tiny USB drives are excellent for use as emergency USB disks

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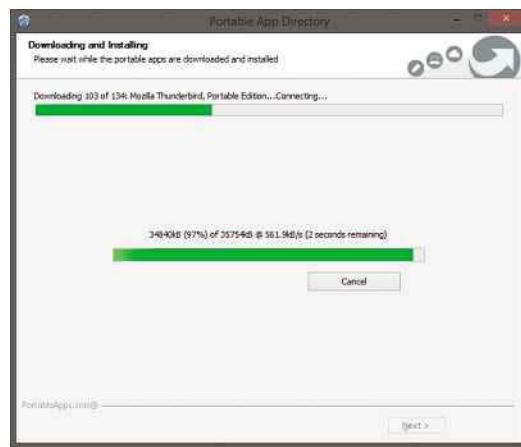


▲ PortableApps lets you pick from a wide range of software, all of which can be installed

invaluable tool wherever you are. Browsers, anti-virus tools, office software, even full operating systems can be carried on a USB drive, ready for use in any PC. So if you need to go to a friend's to fix a PC or want to use your own favourite browser at an internet cafe, you can do so.

There are many portable versions of applications that you can copy onto a USB stick, all of which can be very useful. These are designed to be used in this way and often require no installation. Popular applications like FireFox and Google Chrome all come in a portable version, and you can get email apps like Thunderbird, as well as portable office suites like OpenOffice. There are all available from their respective websites, as are an army of other tools. Searching for and grabbing all of these can take a lot of time, however. Enter PortableApps.com (portableapps.com). This is a free downloadable system that can be set up with a wide range of useful tools, including browsers, office suites, anti-virus, development, graphics, system tools and even games.

The tool is a simple menu GUI that's installed onto your USB drive, which you then customise with the programs and tools you want to include. These are then downloaded and installed on the USB, ready for use when you need them. PortableApps includes an impressive array of totally free software, all of which could be very useful in various situations, and with a drive featuring this, you can instantly be at home on any PC or be able to offer help to anyone on the go.



▲ The software is downloaded and installed for you, although you have to manually confirm the installation of a lot of it



▲ Once set up, you'll have a Start menu-style GUI from which you can access all of your software

It's easy to use; all you need to do is visit the website and download the PortableApps client. Once downloaded and installed on your USB, you'll be given a long list of apps and tools you can pick from. Simply tick the apps you want to install, then click Continue. The installer will download and install each program and tool into your PortableApps suite. It can take a while depending on how much you pick, so be patient.

Once everything is downloaded, you'll have a fully functional suite of tools that can be used in almost any PC. It's an impressive piece of software, with some truly excellent apps, such as the aforementioned big name programs, as well as such inclusions as TeamViewer, McAfee's virus removal tools, system diagnostics and archival tools. You can be sure you're pretty much covered for any instance.

OS On The Go

Of course, perhaps the ultimate way to ensure you have a working PC anywhere is to carry with you a fully portable system. For this you'll need to either go for a special way to install Windows onto a portable virtual system or look to a portable version of Linux (see Linux a go-go).

Linux comes in many flavours of bootable operating system, but Windows is a little more complex and requires more work. You'll also need a substantially larger USB drive. About 8-10GB is recommended here due to the size of Windows, as well as the required visualisation software. You'll also need a copy of Windows along with a licence. Remember, even a virtual installation of Windows counts as a real installation.

To begin you'll need to download the portable version of VirtualBox from www.vbox.me and install it onto your formatted USB drive. Run the portable VirtualBox file, and use the program to create a virtual drive on the USB. Now you'll be able to install Windows on the virtual PC you've set up on the USB drive.

Once the installation procedure is finished, you can use it to boot any PC, and your virtual machine will load your copy of Windows. You can do this with most versions of Windows.

With this portable version of Windows, you can effectively use your own PC wherever you go, as long as the PC you're using allows USB boot and you can do so without trouble. If in doubt, always check. Many internet cafés or libraries may take issue with you rebooting their PCs and booting from USB, and you'll need internet connection information a lot of the time too.

With some special software and a little bit of knowledge, as you can see, a simple USB drive can become a truly indispensable tool. If you have a couple of spare USB disks lying around, give it a go and create one yourself just in case you ever need it. [mm](#)



▲ The portable version of VirtualBox allows the easy creation of a mobile setup of Windows

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Remembering... Acorn BBC Master 128

We look back at a classroom computer and an old friend

Those of us who are old enough to recall sitting in a classroom in the mid-80s will undoubtedly also remember the sudden swarming around one of the school's limited computers.

At the teacher's signal, the students would race over to one of the few BBCs and sit around arguing whose turn it was to sit at the keyboard and whose turn it was to read out from the hastily written BASIC listing in the exercise book. It was a pretty remarkable time to be growing up, although we never realised it at the time.

The BBC Micro was the winner of the government's race to get computers into schools, beating Sir Clive's Spectrum despite being significantly more expensive. The Micro was a great computer for the classroom, though, and looking back a far better fit than the Spectrum would have been. The robust build and easy-to-use nature of the BBC meant it was able to take a considerable onslaught from keyboard-happy teenagers. And thanks to its ever-growing status, it was being upgraded fairly rapidly too.

In 1986, the first significant upgrade was released, the Acorn BBC Master 128. At around £499, it certainly wasn't cheap, but it was a far more powerful school machine than what we'd previously been used to.

Its History

Being the successor to the hugely popular BBC Micro was no easy task, but the Master

128 did a superb job and offered students and teachers (since it was designed for use in schools) a healthy 128KB of RAM, 128KB of ROM (with some sideloading ROM programs that could be paged into a memory area), a numeric keypad, ROM cartridge slots and a Tube interface whereby you could fit an external secondary CPU.

Obviously, it was as robust as its predecessor, and those sideloading ROMs included the rather good Acornsoft View word processor, BBC Basic, Advanced Disk Filing System, Viewsheet spreadsheet package and a Terminal Emulator.

Quickly, Acorn started to release upgraded Master models, with the Master Turbo, which featured a faster processor (one which would be bought as a machine itself or as an upgrade to the existing Master). The Master AIV (Advanced Interactive Videodisk) housed a SCSI port and a Video Filing System ROM, which went on to form the BBC Domesday System to mark the 900th anniversary of the original Domesday Book.

There was also the Master 512, with a 10MHz Intel 80186 coprocessor and 512KB of memory; the Master ET, with an EcoNet Terminal; and the Master Compact, a machine that was slowly beginning to resemble a modern-ish PC.

Sadly, production ended in 1994, and the Acorn BBC was officially laid to rest. However, that didn't stop the legion of

Did You Know?

- The Master Compact had its own GUI.
- The Master 512 could run DOS Plus and GEM.
- The Master Scientific was never released. It was to have an 8MHz 32016 coprocessor and 512KB of memory.
- The original Master 128 had a 2MHz Rockwell R65SC12 processor.

fans, who upgraded their kit with ARM processors and more memory.

The Good

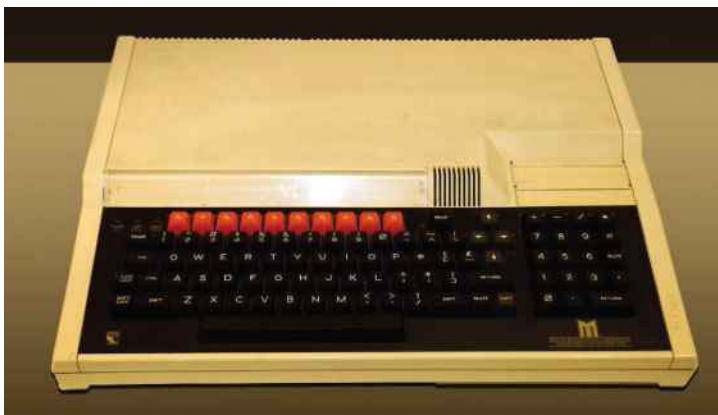
Tough machine, solid construction, more memory, better version of Elite.

The bad

Some of the software (I can't remember which) from the Micro didn't work with the Master. Expensive and heavy.

Conclusion

It makes you wonder: what would have happened if the PC and Microsoft never took off the way they did? Would our standard desktop computer be some distant descendant of the BBC Master, with an ARM processor guiding it through the alternate-universe version of Facebook? **mm**



▲ The Acorn BBC Master 128: an amazing machine in retrospect



▲ The BBC Domesday System, marking the 900th anniversary of the Domesday Book



Component Watch

We look at some deals on last-gen Intel processors...

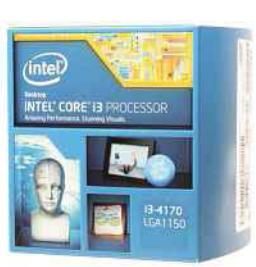
Buying a new CPU is a great way to speed up a system, and just because Intel has moved its focus onto the new Skylake platform, that doesn't mean Haswell is over. Far from it, in fact, because Haswell chips are now cheaper than they've ever been, and probably as cheap as they'll get – unless you want to wait for the January sales, of course, but wouldn't you rather have a PC that can play your new games on Christmas day? We think so. And that's why we've got the best prices on all Haswell chips right here.

Deal 1: Intel Core i3-4170

RRP: £99 / Deal Price: £85.36

The cheapest Haswell Core i3 on the market can be picked up for around £85 if you shop about, and is a dual-core CPU clocked at 3.7GHz with Intel HD Graphics 4400, making it an ideal choice for budget buyers who still want a bit of punch. We wouldn't recommend going any lower unless you're after a purely business system, but the discount especially makes this a good value purchase at the low end of the spectrum.

Where to get it: Scan – bit.ly/1Qed8vK



Deal 2: Intel Core i3-4360

RRP: £119.00 / Deal Price: £107.98

The fastest Haswell Core i3 chip you can buy is the Core i3-4360, which is also a dual-core Socket 1150 chip clocked at 3.7GHz, but with better integrated graphics (Intel HD 4600) and more L3 cache. At this end of the market Haswell is already aggressively priced and competing Skylake chips aren't out yet, so bargains aren't particularly easy to find. Indeed, in many places it's more expensive now than it was 12 months ago, but this deal is still a very good one.

Where to get it: Play-Asia – bit.ly/1LNV1qc



Deal 3: Intel Core i5-4690K

RRP: £172 / Deal Price: £170.39

The Core i5 4690K is one of the fastest Core i5s in the Haswell range. A Socket 1150 quad-core clocked at 3.5GHz,

it's fast enough for virtually all non-specialist use and certainly a strong choice for any home system. It even has the latest on-board GPU in the shape of the Intel HD 4600 chip. If you want an even better bargain, the locked version (the i5-4690) is even cheaper than the i5-4670, but we like the overclocking ability too much to turn it down.

Where to get it: Scan – bit.ly/1Qed8vK



Deal 4: Intel Core i5-5675C

RRP: £229 / Deal Price: £202.98

This Broadwell chip is one of the few to hit the desktop market between Haswell and Skylake, and that makes it quite desirable for people looking for a deal. A quad-core clocked at 3.1MHz, it needs a Socket 1150 board, so if you want to upgrade from Haswell without a new motherboard, this is the one to look at, especially if you don't have a separate GPU, because it contains Intel's advanced on-die graphics, the Iris Pro Graphics 6200. And better still, they're overclockable.

Where to get it: Scan – bit.ly/1TuRqDM



Deal 5: Intel Core i7-4790K

RRP: £289 / Deal Price: £249.99

One of the first and fastest Haswell chips on the market, the Core i7-4790K is an unlocked quad-core Socket 1150 CPU running on the latest Intel architecture, and includes an HD Graphics 4600 GPU. With 4GHz clock speed and 8MB cache, it's one of the fastest you can, especially if you overclock it.

Again, the 3.5GHz i7-4770K is actually priced a little higher in some places at the moment, so don't accidentally get the slower chip, because it's more expensive!

Where to get it: Dabs – bit.ly/1QTMDgG





Hannspree's Powerhouse PC

[Quad-core multimedia tablet device](#)

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From hero to Zero

Just when you think the guys at Raspberry Pi have gone as far as they can go, they go and trump what they've done before yet again.

This time round, it's in the form of the Raspberry Pi Zero. Billed as the firm's smallest (and cheapest, at just \$5) board yet – measuring a mere 65mm x 30mm x 5mm – this teeny, tiny computer comes with the decent specs. It carries a Broadcom BCM2835 application processor with a 1GHz ARM11 core (40% faster than Raspberry Pi 1, according to the company), 512MB of LPDDR2 SDRAM, a micro-SD card slot, mini-HDMI socket for 1080p 60fps video output and Micro-USB sockets for data and power!

If you managed to get your hands on one, you did well. Every one of the 20,000 devices offered in the initial launch were sold in a day. In fact, within the first 12 hours of its launch 80% of the official Raspberry Pi magazine, which shipped with 10,000 copies of the Zero, were sold. There are possibly a few copies still out there to buy, although it will be a lucky spot if you do see one.

The good news is that the company has confirmed in a blog post "we will continue to make Zeros for as long as you guys

want them" and they are also dissuading people from picking up an overpriced one from eBay scalpers. So hang on in there, people. The Zero is coming.



▲ This is how small the Zero is!

AV specialist Hannspree has added a tablet PC to its HANNSpad series. The Titan SN14T72B is marketed by the company as a stylish, powerful mobile tablet system that's being pitched at "serious" tablet users. If that sounds like you, then let us provide you with more information to help you decide on this.

As well as its 13.3" Full HD display housing IPS technology, the Titan comes with Android 4.4, 2GB DDR RAM, 16GB internal storage (with Micro

SD expansion to provide additional storage space up to 32GB), a quad-core processor a couple of stereo speakers, a 5MP rear-facing camera and wi-fi and Bluetooth 4.0, all of which isn't half bad for budget tablet.

Available for £169, the price is certainly in the budget arena and the website for more details on this is www.hannspree.co.uk.



League of Legends Cracks Down

Bad behaviour will no longer go unpunished

Massively multiplayer online game *League of Legends* is massively popular among its legions of fans for good reason. It is also however sometimes a place, as with so many other online activities, for people to bring their brand of negativity on others. Now, though, it would seem Developer Riot Games has a plan to deal with it.

The studio has promised a crackdown on what it's calling "toxic behaviour" and is bringing in rules to punish poorly-behaved players. This news comes courtesy of *Polygon* as its interview with lead game designer Jeffrey Lin let loose the story.

How is the developer going to deal with this "toxicity"? It's going to take away loot, of course. Yes, anyone who doesn't play fair could be under threat of being locked out of the game's crafting and loot system.

The aim, then, is to create a better, more level playing field where gamers consistently carrying out negative behaviour are effectively taken out of the picture. As Lin said in the interview, this is a "carrot" for playing the game positively.



How do free apps make their money? That's the question Rob Leane answers in this week's issue. Although there are a variety of different sources, the main ones are undoubtedly through advertising and in-app purchases (IAPs).

Advertising is a necessary evil if you want something for free, but it's annoying and often intrusive, so having the option to pay for an ad-free version of an app is great, and it's one that I favour. What I'm less keen on is ongoing IAPs (particularly in games, but also in other apps), where you pay for virtual currency or one-off items. I find these to be overpriced and think they reward software companies for doing no extra work, but I can understand why they exist.

Their presence in paid apps, however, is one step too far. I recently paid £15 on a game for my Android tablet and found it full of IAPs, many of which were one-use only. Considering how easily they could be used to bleed players of more cash, I decided the best option was to get a refund and not play the game. Maybe I'm grumpy, but if I pay that much for a game, I don't want it asking me for more money.

What are your thoughts? Write in and let us know.

Anthony

Editor

Meanwhile... On The Internet...

While the big hacks of 2014 – the massive Sony leak and the iCloud photo hack – were headline-grabbing curios, they didn't hit home in the same way as some cyber-attacks of 2015 have. While we may deeply sympathise with celebrities who have their personal photos displayed to the whole world, or the high-profile Sony executives having their private email conversations with and about various actors and actresses pawed over, it actually felt a bit like dispatches from another world that didn't concern us.

2015, however, has seen a good number of breaches that targeted and affected 'ordinary' people. Carphone Warehouse (tinyurl.com/MMnet92a), TalkTalk (tinyurl.com/MMnet92b) and Weatherspoons (tinyurl.com/MMnet92c) have been the big news on this side of the Atlantic, but attacks in the US – like the one on Ashley Madison, which involved users all over the world – have dwarfed them in terms of the number of people involved (tinyurl.com/MMnet92d). The latest news coming out of Hong Kong, though, is especially disturbing.

In the run up to Christmas, many parents will be wondering whether or not their young children would like one of V-Tech's range of smart toys. However, news of a massive data breach involving the company's servers (tinyurl.com/MMnet92e) may well make them think again about whether they would actually want to buy one.

Details of the cyber-attack, broken to the general public (and, it appears, to V-Tech too) by website *Motherboard*, was almost immediately followed by the toy company pulling down several sites and services that appeared to be vulnerable to the same SQL injection that allowed the hacker unfettered access to parts of its database (tinyurl.com/MMnet92f). *Motherboard* says that it became aware of the breach when the hacker responsible reached out to it about what he had managed to do and provided information – including passwords, photographs of parents and children, and even audio recordings – to prove his story. The site asserts that the party responsible said, "it makes me sick that I was able to get all this stuff" and that he has no further plans to distribute it.

Analysis by haveibeenpwned.com (tinyurl.com/MMnet92g) revealed that the hacker's 190GB haul of data included nigh-on five million unique email addresses, along with not-very-secure MD5-hashed passwords (tinyurl.com/MMnet92h) and corresponding reminder questions. According to the site's blog, these numbers rank fourth on its all-time hall of shame, in terms of the numbers affected, but it's "off the charts" considering the information contained name, age and gender information of over 200,000 children, linked to details of their parents addresses and logs of conversations between parent and child. Luckily for those involved, the hacker appears to be a benevolent one, though – as he warns, there's a chance that others hacked the site too.

As more and more toys become smart, the integrity of the information they ask from us and hold about us is going to become ever more important. V-Tech is far from alone in having to step up on this (Mattel's 'Hello Barbie' toy has made the news again recently: tinyurl.com/MMnet92i), but it may be the first to feel the business and legal consequences of getting it very, very wrong. It should certainly be facing a whole host of questions about how its systems became compromised and, indeed, exactly why it was still holding some of the information that it was.

If anyone's ever told you that you shouldn't trust Wikipedia, we're about to prove them dead right. This, however, is not a tale of some unfortunate – albeit slightly lazy – undergraduate getting caught cutting and pasting. Or even a lazy journo skimping on the fact checking. This is a tale of real-world genius exploiting the shifting sands of crowd-sourced knowledge.

There are many things you can do using Wikipedia – not all useful, or approved by teachers – but we never thought that 'getting backstage at a gig' was one of them. How wrong could we be. Thus we relate the tale of intrepid gig-goer David Spargo who, while attending a show by the dance duo Peking Duk (no, we haven't either) in Melbourne, edited the band's Wikipedia entry to include himself as a stepbrother of band member Adam Hyde. Spargo then used the page and his ID to bag a couple of backstage passes from the band's security (tinyurl.com/MMnet92j).

Hyde called the tactic "probably the most genius, mastermind move that I've ever witnessed" (tinyurl.com/MMnet92k), and as blags go we'd have to agree. It does, however, say as much about how trusting Wikipedia too much can cause problems as it does about Mr Spargo's considerable cajones.

You may think your selfie game is strong, but step aside and make way for Kevin Wells, aka **@BigwhopperKevin**, who let us all know what time it was with an epic shot of himself and Public Enemy squished cosily into his Ford Focus (tinyurl.com/MMnet92l). What, you may ask, were these doyens of the rap scene doing in a car with a photographer from Sheffield? Well, apparently Kev stepped in to help Chuck D and co when their taxi didn't turn up to take them to their show at the Sheffield Arena (tinyurl.com/MMnet92m). Top bloke!

What's this, then? 45 minutes of Nick Offerman – aka *Parks And Recreation*'s uber-man, Ron Swanson – sitting in complete silence drinking whiskey in front of a roaring fire as part of his cracking *My Tales Of Whiskey* web-series? Dear reader, we watched it all... and we don't even know why (tinyurl.com/MMnet92n).

.AVWhy?

Videos For Your Eyes...
Not Necessarily For Your Brain

Well, the time is almost upon us... It's the most wonderful time of any year: Star Wars Time – and the publicity drive is in full gear. However, as if to remind us that there are, in fact, other franchises out there, Peters Capaldi and Jackson teamed up to get a rise out of geeks everywhere by teasing the idea that the latter may direct the former in an episode of *Doctor Who* (tinyurl.com/MMnet92o). Oh, and also to hint that Jackson is still keen on returning to the world of Tolkien.





This strange vehicle was the subject of our Caption Competition in issue 1390; here are our favourite submissions:

- **Dwynnehugh:** "Faster than Vista."
- **doctoryorkie:** "Royal Snail."
- **Thomas Turnbull:** "The Dragons Den's idea to speed up Snail Mail."
- **Ondrive:** "Apple finally reveals its plan to build a car... say hello to the iGastropod!"
- **PlaneMan:** "Snail Mail Express."
- **The Duke:** "All new Vauxhall Viva!"
- **Ondrive:** "French snails have evolved to confound their greatest predators... Restaurant goers."
- **Sawboman:** "Nissan S-Cargo be damned, I am the real snail."
- **doctoryorkie:** "AMD inside."
- **Ritasueandbobtoo:** "What is behind Royal Mail 2nd Class!"
- **Ondrive:** "Life in this garden is shell on wheels."
- **Thomas Turnbull:** "Feeling Sluggish? Well things go better with Shell."
- **Dwynnehugh:** "Home on wheels."
- **Phil Williamson:** "Snail mails' answer to email."

Thanks to everyone who entered, but the best of the week was Think Tank with the wonderfully simple "A hybrid drive".

To enter this week, come up with something to accompany the picture below, head to the 'Other Stuff' section of our forum (forum.micromart.co.uk), or email us your funnies via caption@micromart.co.uk, remembering to add the issue number to the email subject line. Kampai!



Zing Zooms In To Take On Apple

Smartwatch under £60

Scientists of Cambridge, rejoice! Some of your number have developed a wearable smartwatch for less than £60 and we'd like to point people in its general direction.

The Zing watch costs from £54.99 and it's a multi-use smartwatch covering all the usual suspects: fitness, games, interacting with friends. It can be worn as

a watch, pendant or just kept in your pocket and while claims of this being a 'must-have' item are probably a little too keen, it's got a fair bit of functionality on board, including controlling your phone's music and being able to monitor mood and movement via its range of built-in sensors.

If wearables are your thing, the website for a better look at the Zing range is mvbii.com.



Zing: meet the family

Smartphone Smart Chip Promises Quick Charge

The things they develop these days...

Singapore's Nanyang Technological University is home to Professor Rachid Yazami, a rather clever chap who has developed a smart chip for use in smartphones and other devices that could charge a phone in mere minutes.

The development means that Professor Yazami can now go and speak with the chaps over at Tesla as he wants to see

whether he can get this chip into the company's electric cars. He probably deserves to be listened to at least, given the work he's put in to this – he's been working on the development of the chip for over five years. The chip also promises to reduce battery fire risk as while Lithium-ion batteries have energy drip-fed in them to avoid overheating, his chip can be recharged at full tilt.

Snippets!

Swatch Watch Will Pay

Swiss watchmaker Swatch has teamed with Visa to let cardholders in the US, Switzerland and Brazil make payments using Swatch's "pay-by-the-wrist" watch, the Swatch Bellamy. It's slated to launch early next year and the Swatch Bellamy can be used around the world wherever contactless NFC Visa payments are accepted. Paying for things on a watch? It'll never catch on...

Hacked Users Return

Would you go back to a website that had previously suffered a security breach? According to global information security outfit NTT Com Security, a quarter of over 500 UK consumers polled would. Of course, it's also worth noting that over two thirds of online users asked would immediately stop using a bank or retailer if the site suffered an attack, but the news that a quarter would carry on regardless is interesting, nevertheless.

Another stat? Nearly 80% of those asked would do "most" or "some" of their Christmas shopping online. Well, duh.

PAC-MAN Bags

Bandai Namco should be a company you're familiar with, having been responsible for some of the most recognisable gaming characters ever. It's also just announced the opening of its official online store, offering items sporting designs based on PAC-MAN, Tekken, Galaga and more. Offering products including mugs, bags, posters, t-shirts and phone cases, there could be something for gaming geeks everywhere. The exclusive items can't be found elsewhere and include a series of unique designs created by 35 artists to celebrate the 35th anniversary of PAC-MAN. Head to **BandaiNamcoEnt-Store.com** to see if anything there takes your fancy.

Amazon Drone Footage Promises 30 Minutes Delivery

More drone developments for online retailer

Another day, another drone announcement from Amazon. This time round, it's its Prime Air hybrid delivery drone that can fly vertically and horizontally under 400 feet and to distances of 10 miles or more. Amazon claims that this development means deliveries within 30 minutes of an order being placed, and trumpeted the concept in a video introduced by one Jeremy Clarkson.

The drone is kitted out with various sensors that mean it should be able to detect and avoid any obstacles – clearly an important thing – and it would appear that Amazon is spending significant time and money on trying to get its drone deliveries off the ground, so to speak.

With Prime Air development centres across the UK and United States working on making this vision a reality, you can be sure that this isn't the last we'll hear on this. Certainly not if Jeremy Clarkson's planning to prove his worth.



Trolls Shown Up On Billboards

Brazil takes a novel approach

This is a new way of dealing with online trolls. A campaign in Brazil is collating various hurtful and abusive comments left by users on Facebook or Twitter and posting them on very real, very large billboards. The real catch? The billboards will be posted near the trolls' houses.

The campaign is called 'Virtual racism, real consequences' and you can it at work for yourself at racismovirtual.com.br/virtual-racism. Run by a civil rights organisation that collects the comments posted on social media and then

finds the location of who posted them by using geolocation tools, all that has to be done then is to buy the billboard space in locations near to where the trolls live. On said billboard, post the comments in very bold letters (although blocking out the names and photos of those responsible) and Hey Bingo, you have yourself a pretty effective campaign against online abuse.

As a way of shining a spotlight on the very real and present problems surrounding abuse encountered on the web, this campaign is certainly offering something a little different.

QUICK BITS... Electronic toy company VTech was the latest high-profile victim of hacking with data of

Wi-fi, Meet LiFi

Light-based web access faster than wireless

While Virgin and other broadband providers work hard to bring us faster wireless speeds, an Estonian firm has announced a li-fi enabled lightbulb that can transmit data at speeds of 1Gb/s. According to the International Business Times, during lab tests the theoretical top speed reached up to 224Gb/s.

For this to work, you need an LED lightbulb, a web connection (naturally) and a photo detector and the system uses the visible spectrum. Radio waves? So last year. Taking advantage of the visible light spectrum, which is 10,000 times larger than the radio waves spectrum, this could possibly be a significant development in communications. Or maybe not. Time will tell.

Pirate Settles Over Court Case

Damages avoided through odd punishment

Software pirate Jakub F was told by a court judge that he had two choices when facing a charge of copyright infringement: pay significant damages or produce a YouTube video. Guess which option he took?

The Czech court appearance related to software that he pirated with firms including Microsoft, HBO Europe and Sony Music among the group of companies suing him. Damages were estimated at around £150,000 and things could have been much bleaker for Jakub F,

had the alternative option not been available. Naturally he took it and, with the co-operation of the affected firms who accepted a much smaller settlement payment, he produced an anti-piracy video that was posted on YouTube. Jakub had to get 200,000 views for the video, which he easily achieved, and the idea is that as he's spread the message against piracy to a whole lot of people, he's done his bit for the anti-piracy movement.

Well done, that man. Or rather, not so well done for being a pirate in the first place.

Ofcom: Beware Christmas Lights

Wi-fi impacted by the festive season, says watchdog

Communications watchdog Ofcom has released a mobile app that can check whether other signals transmitted around your home are affecting the strength and quality of your home broadband.

The WiFi Checker app samples wireless signals and checks for any interference from the usual suspects – baby monitors, microwaves and such like – and also, particularly relevant for this time of year, Christmas fairy lights. Yes, it turns out that spreading some festive cheer around the home might also be spreading web interference from the electrical signals.

If there are problems, the app then provides some tips (albeit fairly obvious ones) on how to possibly improve your broadband speeds. Ofcom has also got some research data via its Connected Nations 2015 report that suggests that "good progress" has been made on the availability and take-up of communications services with generally better coverage and quality of fixed broadband services over the past year.

Naturally, it's not all good news though with 8% of homes, around 2.4 million, said to be unable to access speeds of 10Mb/s or more. Hrumph.



Asus ZenBook UX303UA

A stylish laptop that can keep up with you

DETAILS

- Price: ~£970
- Manufacturer: Asus
- Website: goo.gl/3GfiHH
- Requirements: Microsoft account

The Asus ZenBook UX303UA range has been around for over a year now and has moved up through the various processor releases while still retaining its sleek looks and lightweight charm.

The newest version to grace the shelves is the UX303UA, with a choice of Intel processors ranging from the i3 6100U through to the i5 6200U or the more powerful i7 6500U – the model we're looking at in this instance.

The Intel i7-6500U has a base clock of 2.5GHz with a boost frequency up to 3.1GHz, and it does an excellent job of helping to drive this 13.3" laptop. The model we had available was fitted with 8GB of DDR3L 1600MHz memory, which is more than enough for Windows 10 64-bit installation to fly along nicely, but you can opt for one with 12GB installed.

You also have a choice of storage: a 128GB SSD, a 256GB SSD (which was in our model), a 500GB HDD, a 1TB HDD, or a combo of 500GB and 8GB SSD. Obviously, the price will alter depending on what you opt for, but even with the lowest 128GB SSD specification, there's enough storage capacity for the majority of users.

Other connectivity consists of a two-in-one card reader, 802.11 a/g/n/ac wi-fi, Bluetooth 4.0, a combo headphone and microphone jack, three USB 3.0 ports, a mini DisplayPort and a standard-sized HDMI port.



▲ The screen of the Asus ZenBook UX303UA is exceptionally good



▲ And the style of the chassis is superb too

All these are spread along the sides of an exceptionally thin laptop that's just 19.2mm at its thickest point, narrowing to an incredibly slim 4.5mm. However, it's not the thinness of the UX303UA that is its most endearing feature, because this is one of the best-looking laptops to ever land on our desks.

The beautiful all-aluminium chassis, with a spun metal finish and indented Asus logo

are really quite appealing. The colour effect on our model was called 'smoky brown', but there are other colours available, including one that's a metallic pink – or Rose Gold, as it's more popularly known.

Opening the lid reveals a nicely laid out keyboard section, with decent-sized and well-spaced keys and a large trackpad that's pitched at just the right sensitivity level. One particular element we didn't particularly

like was the power button, located in the top right of the keyboard. For some reason whenever we went to hit the Backspace key, we ended up missing it and entering the laptop into a power saving mode. It's a silly mistake to make, but we'd have preferred the power button to be located to the rear or side of the laptop as opposed to being an actual key on the keyboard.

The 13.3" IPS display looks exceptionally good, and thanks to the Intel HD 520 graphics, it does a good job of displaying media and even some lightweight gaming to great effect. There's also an anti-glare finish to the screen, which is a definite plus for those whose desks are located under the usual office strip lights or who have their back to a window. It works well, and the screen is bright and colourful enough to prevent sore eyes at the end of the day.

The Asus ZenBook UX303UA performed very well indeed. Windows 10 ran perfectly fine, as did a selection of video viewing and editing programs. It's a decent powered laptop, it looks great, and it performs well.

mm David Hayward

Spectacular looking, with good all-round performance



Netgear D6400 AC 1600 Modem Router

The Netgear D6400 comes in any colour you'd like, as long as that's black

DETAILS

- Price: £114.99 (PC World)
- Manufacturer: Netgear
- Website: www.netgear.co.uk
- Requirements: ADSL, VDSL or cable broadband
- Model no: D6400-100UKS



Sometimes it is better not to be at the front of a queue, oddly enough. A good example of why is the Netgear D6400, which when it launched earlier in the year cost roughly £150.

If it had crossed my reviewer inbox, then I'd have torn it a new one for being overpriced, but given an adjustment, it now seems like a much more realistic prospect.

As Netgear routers go, this one is a rather understated black plastic bevel box, which does its best to hide all the cabling connections at the back. It supports ADSL and VDSL through an internal modem, and you also get a red WAN Ethernet socket if you have a cable connection. There are four other standard LAN ports provided, and they're all 10/100/1000 speed rated.

What most people would buy this for wouldn't be Ethernet; it

would be the AC 1600 wi-fi that uses 2.4GHz and 5GHz, and supports IEEE 802.11 a/b/g/n/ac standards.

Unfortunately, like so many AC-class routers these days, the speeds emblazoned on the box remain mostly theoretical. During my testing I got nowhere near those performance levels, especially using the 2.4GHz spectrum. For those that have 5GHz gear or ideally dual-band hardware, things are markedly better, though nothing amazing. The best performance I got was about 150MB/s by using an AC-class USB 3.0 dongle that the D6400 seemed to have a natural affinity with.

This underlined for me the whole problem with 802.11ac: until we get rid of all the 'G' and 'N' stuff, we're unlikely to see what this technology can truly do. And in the meantime, the technology seems destined to disappoint.

What I do like about this design is that Netgear has included two USB 2.0 ports, not tried to oversell them as USB 3.0, and also added a DLNA-compatible media server to the firmware.

These are the sort of features that people find really useful, and Netgear also supports remote access to any external storage attached via its own Genie app for iOS or Android devices. It won't replace a proper NAS box performance wise, but it's useful for anyone for whom the expense of maintaining their own server isn't justified.

My only other complaint about this design is that Netgear designed it to be exclusively upright but entirely forgot that

the most natural place for it would therefore be on a wall. You can't mount it, and the support foot doesn't detach.

For many BT customers, the D6400 would seem the ideal replacement for their aging Home Hub 3, as it has many similarities to the current BT Home Hub 5. The problem there is that BT sells the Home Hub 5 for £69 to existing customers, and even bundling in a couple of BT-made AC dongles doesn't make it cost more than the D6400.

The new, lower pricing of the D6400 makes it more attractive, but it still has some way to go before it competes with the cheapest AC 1600 and gigabit LAN routers around.

mm Mark Pickavance

An all-services router at a more affordable price

Features

- Works with ADSL and VDSL (BT Infinity).
- Five gigabit Ethernet ports.
- AC 1600 dual-band wi-fi.
- DLNA and FTP server.
- SPI and NAT firewall.
- Beamforming+ technology.
- WPA/WPA2 encryption.



Asus MG278Q 27" Gaming Monitor

Is this high-end display worth its high-end price?

DETAILS

- Price: £400
- Manufacturer: Asus
- Website: goo.gl/2CPPgl
- Requirements: PC or device with HDMI, DVI or DisplayPort output

As a tech journo, you might expect me to own a top-of-the-range PC plugged into a pin-sharp display the size of Norway. But alas, no. Currently, I do the majority of my work on a 15" laptop with a resolution of 1280 x 800 and my gaming on a 1080p 21" inch monitor, so it was difficult not be impressed when I unboxed this screen from Asus. At 27 inches, it's a significant upgrade to what I'm generally used to, and if you're in the same boat, you might be tempted to think that this is what counts. The bigger, the better right?

The answer, of course, is an emphatic yet, but also no. You can easily pick up a display this size for around £150, so if you're going to be throwing down 400 quid for one, you expect something that offers a lot more than your average monitor.

So what do you get for your money? Well, as I was setting it up, a few answers to that question became apparent. The screen (a TN panel) is light but sturdy, with support for VESA wall mounting kits, and it connects easily to the stand. And what a stand it is. Once connected, you have access to a wide range of movement, so you can tilt and swivel the monitor into the perfect position, plus it pivots 90 degrees, so you can view it in portrait mode as well. What I particularly liked, though,



was the height adjustment. With cheaper monitors that I've used, there is hardly any ability to raise the screen to a comfortable height, but with the Asus MG278Q, it moves vertically with ease and to a good height.

This all makes for an excellent first impression but, of course, the technology itself is even more important. To start with, it offers a maximum resolution of 2560 x 1440, otherwise known as WQHD. Plus you get a decent amount of connectivity, with two HDMI ports, one DisplayPort and a single DVI input. In addition, there's a 3.5mm analogue audio input, a headphone jack and a two-port USB 3.0 hub. These are all located at the back of the monitor, facing downwards. This does make it little awkward to plug things

in, but ultimately what matters is that they won't impede wall mounting, should you decide to take that route.

Once you've hooked everything up, you can just turn on your PC, then the monitor, and be away. Chances are, though, if you've spent this much on a display, you'll want to play around with the settings a bit to get the best from your purchase.

To do so, you use a series of buttons located behind the screen on the right-hand edge: power, GameVisual, GamePlus, input select, close and a five-way control nub. Some of these are self explanatory, while the GameVisual and GamePlus buttons simply allow you quicker access to settings that already exist in the OSD, which you navigate with the

five-way control. Clicking this nub inwards brings up the OSD, and from there you can customise or select a number of different options, including the basics, such as brightness, sharpness and contrast, as well more advanced settings. You can also save up to four different custom configurations for easy selection later.

If you'd rather use presets, then that's what the GameVisual modes are for. Offering scenery, racing, cinema, RTS/RPG, FPS and sRGB modes, these are supposed to give you optimal settings for different types of games or media. To be honest, I can't say I found them particularly to my liking, but I would say that's something I find with all displays or TVs, and I'd much rather create a configuration that suits my own preferences.

Thankfully, Asus provides plenty of ways for you to come up with something that suits you. In the colour menu, for example, you can alter a variety of settings, including, among the usual kind of options like contrast and saturation, a couple of more unusual choices: Skin Tone and Smart View. The former, as you can probably guess, enables you to change how skin tones are displayed, while the latter, according to the user guide, offers "versatile viewing positions". This is supposed to get around the viewing angle

problems associated with TN panels, and it does this by brightening the screen. The result is a somewhat washed-out image, so you'll need to mess with the settings to get this right. Seeing as most people will likely be viewing the MG278Q head on, though, it's not necessarily something you'll need anyway. What you might find of more use is the bluelight filter, which grants four levels of filtering, so you can stop those pesky light waves from keeping you awake at night.

Heading into the Image menu, again you'll find common

settings like sharpness and aspect ratio control, and again there are some more exotic things on offer: Trace Free, which speeds up the response time by Over Drive technology; ASCR, which toggles dynamic contrast ratio; and VividPixel, an Asus technology, which appears to just sharpen the screen a bit more.

Using all these settings, you can make the MG278Q truly shine, and it really doesn't disappoint. Artists and photographers might desire the abilities of an IPS panel, but for gamers, the speedy 1ms response time of this TN-based screen is ideal. And thanks to its FreeSync support, you can get the refresh rate right up to 144Hz, which means ludicrous frame-rates without the worry of input lag or screen tearing.

Aside from altering the display qualities, the MG278Q also offers some more novel features, via the GamePlus menu. Here you have a choice of a frame-rate counter, a timer and a crosshair, all of which can be laid over everything else on the screen (although not, as far as I could tell, simultaneously). Having a frame-rate counter built into the monitor is great for gamers, because it means you don't have to rely on games to provide one or to run third-party software, which can often have a negative impact on performance. The crosshair, obviously designed for first-person shooters that don't display an aiming reticle is certainly useful, but it also seems like cheating. Whether or not that bothers you is a personal matter, but it's there if you want it.

There are quite a few more options that you can tweak, which there simply isn't room to

mention, but as great as all this is, nothing is perfect, and there are few flaws even with this high-end product. Predictably, the speakers aren't great, but this is common to nearly all monitors, and they do still serve a potentially useful function for system diagnostics, such as testing your on-board audio or DisplayPort audio output.

More annoying, however, is the fact that when you turn on the bluelight filter, the MG278Q defaults to the racing preset. Why it does this, I'm not sure, but it would forgivable if it returned you to your previous settings when you turn the filter off. Instead, it leaves you with the racing setting turned on, which I found not only irritating, but also a tad rude. Still, it's an admittedly small problem and one that's easy to turn a blind eye to.

Hard to ignore, though is the price, because it's enough to make the average man's wallet weep in shame, but that doesn't mean this monitor is poor value. The simple fact is that you get what you pay for, and this case that's a display that comes packed with features and that will make gaming a pleasure, as well as being suitable for video and everyday tasks.

mm Anthony Enticknap

A high-quality screen ideal for gamers



Specifications

- **Model:** MG278Q
- **Panel size:** 27.0" W (68.47 cm)
- **Max resolution:** 2560 x 1440
- **Brightness (typ.):** 350cd/m²
- **Intrinsic contrast ratio (typ.):** ≥1000:1
- **Viewing angle (CR>10):** 170°(V) /160°(H)
- **Display colors:** 16.7 M (True 8bit)
- **Response time:** 1ms (GTG)
- **Satellite speaker:** 2W x 2 stereo
- **Earphone output:** Yes
- **HDMI input:** Yes (HDMI 1.4 X 1, HDMI 2.0 X 1)
- **Dual-DVI input:** Yes
- **DisplayPort input:** Yes
- **Audio line-in:** Yes
- Yes (Upstream x 1, Downstream x 2)
- **USB 3.0 hub:**
- **FreeSync:** Yes
- **Power on consumption:** < 38.7W*
- **Chassis Colors:** Black
- **Power saving mode:** < 0.5W
- **Power off mode:** < 0.5W
- **Tilt:** -5° ~ +20°
- **Swivel (angle):** +60°~−60°
- **Pivot (angle/direction):** 90° (clockwise)
- **Height adjustment (mm):** Yes (0~150mm)
- **VESA wall mounting:** Yes (100mm x 100mm)
- **Phys. dimension (WxHxD):** 624.96 x 563.31 x 233.40 mm
- **Phys. dimension w/o Stand:** 624.96 x 368.23 x 62.60mm (WxHxD)
- **Box dimension (WxHxD):** 753 x 452 x 224 mm
- **Net weight (est.):** 7.65 kg
- **Gross weight (est.):** 11 kg
- **Voltage rating:** AC 100~240V (built-in)

UP Mini 3D Printer

Proof that 3D printing is alive and well

DETAILS

- Price: £558
- Manufacturer: UP/Denford
- Tel No: 01484 728000
- Website: goo.gl/UF0p4I
- Requirements: USB port, Windows XP or later, Mac OS X

3 D printing never really caught on quite as well as most of us expected it to. By now, we thought 3D printers would be as popular as regular 2D, paper printers. But they're not.

There are a number of factors that contributed to the lack of a 3D printing revolution, but we won't get into them all here. However, two of the main contributing factors were cost and ease of use.

The UP Mini 3D Printer, supplied by Denford Ltd, is an example of how we may yet see 3D printers become regular household items of technology. This is a remarkably compact and lightweight model, measuring just 240 x 340 x 355mm and weighing a mere 6kg. But there's a lot more to this tiny printer than you would expect.

The UP Mini comes as a complete, built package, so there's no need to dig out the soldering iron and a collection of different sized screwdrivers in order to build it from a box of parts. The only items that you're required to install after unboxing are the spool arm fitted to the rear of the

▲ The UP Mini 3D Printer is a compact but quite amazing device



printer (which, incidentally, is a 3D-printed component); the actual print head itself, which slots into position easily thanks to three magnets; and the insertion of the print cellboard over the heated print bed/platform.

It only takes a few minutes to carefully put everything together, and once done you can install the necessary driver and UP software to initialise and configure the printer. Again, though, the process of calibrating the printer is a simple enough affair, as all you need to do is initialise the print nozzle and poke the end of the filament

spool through a hole in the top of the print head and set the maximum height of the print bed to within a fraction of a millimetre off the print nozzle – all of which can be done by eye.

The included software isn't quite as complex as other 3D modelling examples available. You won't be able to create your own 3D models with it, but you can take an already designed STL file and change its scale and position, and you can also fix any angle problems that would cause the printer to fail when it comes to actually printing the object.

Despite the small footprint of the UP Mini, it does offer a decent-sized print size (up to a maximum of 120 x 120 x 120mm) and an optimum layer resolution of 0.2mm. This translates to a reasonably good quality of printed object, available in a number of colours depending on which PLA or ABS reel you install.

We managed to print out a selection of named keyrings, the STL files of which we found on Thingiverse, as well as a dust cap for a Celestron 5SE telescope. Each object printed perfectly well, with a more than acceptable

resolution. The minimum time to print was around four minutes for a keyring displaying the name 'Joel' and up to 25 minutes for the dust cap.

We were pleasantly surprised that everything we

We've had a few 3D printers in the past, and each had a problem with a poorly heated platform and portions of the object being printed cooling quicker than the opposite side. This inevitably led to the object rising slightly off the

where the printing takes place. This works like an oven for the printer and keeps the temperatures inside at an ideal constant for printing. This means you can happily leave the UP Mini printing a bigger, more complex object without having to continually monitor it or create elaborate methods to retain the heat of the platform and nozzle.

The UP Mini 3D Printer currently costs £558 from Denford Ltd, and with this you get the printer itself, a 700g spool of white ABS filament, a set of heat protecting gloves, a power brick, a USB cable, a six-piece precision modelling knife, three cellboards, a pair of snips, tweezers, a scraping tool and the necessary tools

to maintain the printer during its lifetime.

The only slight problem we had with the supplied components is the relatively small USB cable, but since the UP Mini uses a standard Type-B USB connection, it was fairly easy to find a longer version that could stretch from the PC to the printer.

The UP Mini 3D Printer is the entry-level model available from the range, and it does a fantastic job of getting the user up and running within minutes. It's fast, easy to use and is small enough to sit on a desk without taking up too much room.

With Windows 10 offering the 3D Builder app as standard, now may be the ideal time to get into 3D printing, and we can certainly recommend the UP Mini 3D printer as the ideal foundation.

mm David Hayward

Excellent performance and great value for money



▲ With some clever designs available, you can print your digital imaginings

Razer Diamondback

The legacy continues...

DETAILS

- Price: £79.99
- Manufacturer: Razer
- Website: www.razerzone.com
- System requirements: A USB port, a claw grip and a hefty respect for a long-standing name



The Diamondback is, frankly, a stalwart of the Razer product line. First launched in 2004, the model has remained in the company's range and stays in the market as one of the most popular (and versatile) mice available. The reason for both is obvious: its ambidextrous design. It's a legacy Razer has rejuvenated for the 2015 model, so again the Diamondback welcomes left- and right-handed users alike.

Yet as nice as it is, the refresh of this market veteran is more than the waft of nostalgic whim. In reality it's because of the 16,000dpi '5G' mouse sensor the company has. The sensor the Mamba, Mamba Tournament Edition and Naga Chrome models are also now endowed with. And so it is the most sensitive mouse sensor in the world is the driving force behind newer model.

As reasons go, it's a rather pragmatic one. The company clearly has an edge and a claim currently not matched in the market, and one not likely to soon be. But does a sensor a new mouse model make? Not entirely, and Razer is aware of it: the 2015 Diamondback has undergone a little aesthetic refurbishment, as well as levelling up its abilities.

It's still matt black of course but is now more akin to the aforementioned Naga and Mamba stablemates. It also now

features the 16x LED 'Chroma' lighting system Razer has imbued those very mice with. Configured with the company's Synapse tool, there are millions of colour variations to choose from. Handily, the tool also provides access to all the performance, mouse mat calibration, macro and statistical needs you might require, so there is (rather literally) more than meets the eye.

The Diamondback is certainly worthy of such software support, but the Synapse also highlights a missed trick with the new model: there's no DPI selector anywhere on the mouse. It's bizarre at best. As with both Mamba models, Synapse allows you to specify a DPI down to a single digit, but in recognising the Diamondback is attached to your PC, the tool removes the interval option from the 'Performance' section of the interface. Of course, it is smart to remove an invalid option for an attached peripheral, but the lack

of the physical button is frustrating. Is there any reason it shouldn't be a standard inclusion by now on enthusiast products, particularly when even my £15 Kensington Pro Fit includes one?

It's odd, but whatever the decision behind the lack of DPI selector (staying true to the mouse's design heritage?), this Diamondback is smart and well refreshed. Side-buttons adorn either side of the mouse, and the addition of easy-grip rubber just below both sets is commendable (even if both seem at an odd angle). Yet it's worth recalling that the Diamondback has long been a haven for the left- and right-handed claw-grippers of the market. Not something I, a humble palm-gripper, can perhaps fully appreciate all intricacies of.

What I do appreciate is the inclusion here of the same robust, pimpled scroll-wheel as is present on the Mamba

models. Also, the precision with which the light, 89g Diamondback can be used, even as it assures you of its build quality. Another for the 'slightly odd' pile is the inclusion of only a single-direction tilt-wheel on an ambidextrous device, but I'm not sure how popular tilt functions really are overall and whether that might prevent a purchase. Personally, I never have need for it.

My thoughts overall? I like it, this new Diamondback. This refreshed 2015, smile-inducing, stalwart. I used its predecessor for a long time as my main ally in the MM shed (circa 2011), and the feel of it under-hand is certainly familiar. With specifications mightily amped and visual effects now in line with Razer's clear design vision, it's a welcome return for a faithful name.

mm Kevin Pocock

The Diamondback lives – and rightly so



SteelSeries Stratus XL for Windows + Android

SteelSeries promote the console experience for PC and tablet owners

DETAILS

- Price: €59.99
- Manufacturer: SteelSeries
- Website: goo.gl/9LWY0R
- Requirements: Windows PC (using Xinput or DirectInput) or Android device with Bluetooth networking

Eighteen months ago, I reviewed the original SteelSeries Stratus and was critical of it for a number of reasons. My top two complaints were how small it was for anyone with large hands and that while it used Bluetooth technology, it only worked with Apple iPads and iPhones.

Therefore, I'm delighted to report that the Stratus XL is not only a similar size to a typical Xbox/PS4 controller, but it's also available in a model that supports Windows and Android machines.

SteelSeries now makes a separate version of this for iOS, should you want the same button-bashing experience with your Apple equipment.

Picking up this controller for the very first time, I was delighted to discover that my hands dropped very naturally onto the derivative combination of buttons, flippers and dual thumbsticks. If you've ever used a console controller, the Stratus XL is incredibly natural to hold and operate, and it makes PC games a much more console-like experience.

Included with the controller are two AA batteries, and after those are installed you



can pair this with any Bluetooth-enabled device that understands controllers.

SteelSeries, as you might expect has done a stellar job on the construction, and the Stratus XL is at least as good as the branded controllers made for the Xbox One and PS4, and in some respects it's actually better.

The added bonus on the PC is that you can use SteelSeries Engine 3 software to customise the sensitivity of the joysticks to eliminate accidental input or invert the axis, tailoring it

exactly to your specific needs. Those adjustments are rather important with the thumbsticks, because without adjustment, I found a tendency to over-control due to how the self-centering mechanism works.

The only other complaint I have is that the four-letter buttons make a very audible clunk that seems to resonate through the casing.

For Android users there's another problem that SteelSeries can't really address: specifically the very limited number of Android games that take

external controls. Most are inherently built around touchscreen control, and only a few of the better racing or shooting games support Bluetooth controllers.

Hopefully, that will change, because the few that do work with it are certainly enhanced by using the Stratus XL.

Battery life is about 40 hours on a pair of alkaline cells, though I can't see any reason why you shouldn't use rechargables. Helpfully, there's a four-LED display giving you feedback about the amount of charge left.

Based on how well made the Stratus XL is, the price is about right, and it can be found cheaper for those willing to sniff out a deal. The RRP is roughly the same as Microsoft's Xbox One controller for PC, although that isn't Bluetooth.

If you don't have Bluetooth on your desktop PC, then that's an extra minor cost you'll incur to connect it, but we're only talking a few pounds to add that connectivity, so it's barely a problem at all.

mm Mark Pickavance

A good console-style controller for PC and Android



GROUP TEST

Mid-range Graphics Cards

A few weeks ago we looked at some mid-range motherboards priced between £50 and £130. With that in mind, this week, we thought we'd take a look at what graphics cards are available for this mid-range price.

Mid-range Graphics Cards

EVGA GeForce GTX950 FTW 2GB

DETAILS

- Price: £99
- Manufacturer: EVGA
- Website: goo.gl/qxGkVs
- Requirements: Spare PCIe slot, eight-pin connector, 400W minimum PSU



▲ The EVGA GTX950 FTW is an exceptional GPU

The GTX950 mid-range GPU is a card that's designed for value for money, without sacrificing performance, especially when it comes to 1080p gaming.

The EVGA GeForce GTX950 FTW (For The Win), though, is designed for the everyday gamer who wants a little more from their mid-range GPU. The GM206, Maxwell-powered GPU has a base clock speed of 1203MHz with a boost up to 1405MHz, both of which are 17% and 18% respectively above the reference 950 and a memory clock of 1653MHz. You'll find 768 CUDA cores, 2GB of GDDR5 memory with a bandwidth of 105.76GB/s and a dual BIOS to allow you to switch between differently tweaked profiles.

Connectivity consists of DVI, HDMI and three DisplayPorts, giving you a maximum of four supported displays with a maximum digital output resolution of 1096 x 2160.

Special attention has been paid to the cooling and heat dispersion. The GTX950 uses three 8mm SHP (straight heap pipes) cooling across the main GPU and memory chips as opposed to the usual U-shaped heat pipes normally associated with many cards. In theory, this should lead to a more efficient method of cooling – up to 6% better according to the specs provided.

On top of the large heatsink, EVGA has used its ACX 2.0 cooling solution, which consists of a pair of 90mm fans with optimised swept blades, double ball bearings and a low-power, three-phase, six-slot motor. The result is a much lower use of power to drive the fans, while keeping the fan weight down and improving the amount of air that can get to the GPU and the surrounding components. As a brief test of this, we ran the fans at the maximum speed, around 3450rpm and recorded an idle GPU temperature of just 21°C.

There's a lot to like about the EVGA GTX950 FTW. When fitted to our test system, with a Gigabyte Z97M-DS3H, a 4GHz Intel i7-4790K, 16GB of memory, a 120GB SSD and Windows 10, we clocked a 3DMark 11 score of 8,732, which is one of the best we've seen from a mid-range card (it's only 4,000 shy of a 4GB GTX970). During this, the GPU temperature topped out around 64°C with an average fan speed of just 800rpm.

Overclocking on the EVGA GTX950 is easily handled via the Precision X software, which presents a busy dashboard where you can alter

the voltage, GPU clock offset, memory clock offset, fan speeds, GPU temperature target and power target across ten different quick-select profiles. With this latest version of Precision X, you're able to tweak the card's settings to quite an accurate degree and monitor the results through a number of dials and read-outs in real time.

The EVGA GeForce GTX950 FTW is a superb mid-range graphics card. It has been excellently designed, pitched at the right level of gamer and enthusiast and is perfectly tweaked for modern systems. The pricing isn't too bad either: at around £99, it's certainly an affordable and worthy upgrade to consider, or it could perhaps be used in a multi-GPU system.



Sapphire R7 240 4GB

DETAILS

- Price: £70
- Manufacturer: Sapphire
- Website: goo.gl/dSKTz1
- Requirements: Spare PCIe slot, 400W PSU minimum



▲ Unfortunately, it's not the fastest example of a mid-range GPU

Sapphire is a company with a history that can be traced back to the turn of the millennium. 2001 saw many an enthusiast drooling over the latest Sapphire release, so we were looking forward to getting into its Radeon R7 240 version.

The R7 240 from Sapphire features an Oland Pro GPU variant running at a 730MHz core clock speed, with a boost up to 780MHz. The DDR3 4GB memory runs at 900MHz, with the card having a TDP of 30W.

It's a relatively compact single slot card, measuring 145 x 95 x 15mm, with the design looking rather like an old

Voodoo Banshee from some years ago. It's effective enough and offers VGA, HDMI and single link DVI outputs. The lack of a huge amount of fans or a larger heatsink doesn't appear to affect the card too much or create any major overheating problems. However, it did get a little hot to touch after we ran the

benchmarks – hotter than the EVGA GTX950 we've already looked at, anyway.

There's plenty of scope for playing last year's triple-A titles, and the likes of *Skyrim* and so on look wonderful when played through this card. Moving on to FutureMark's 3DMark 11, the score of 2,650 isn't really much to get excited about, especially if you're looking at this card driving a games system that's going to be playing *Fallout 4*, *Assassin's Creed: Syndicate* or even *Star Wars Battlefront*.

While the numbers may not elicit much of a response from hard-core benchmark fanatics, the cost of the Sapphire R7 240 has to be taken into account. This is a card that costs just £70, which is pretty good considering you're getting a 4GB graphics card.

Although you'll be able to play some great titles from a year or so ago, you won't be able to enjoy the highest possible settings, especially in the latest games. In some ways it all depends on what you want. The EVGA GTX950, for example, is more future proof,



whereas the R7 240 will find itself unable to cope by mid-2016 at best.

On the other hand, for £70, this is a perfectly fine single-slot 4GB card. It plays Blu-ray content and streaming HD content, and it manages higher-end video editing well.

The only problems we had were the heat build-up during the benchmarks (which could be a concern if your system isn't well ventilated) and the Catalyst Control Centre drivers that refused to be installed a couple of times on our test system. Eventually, they installed correctly and everything worked a treat, but someone with less computing experience may have trouble.

The Sapphire R7 240 4GB graphics card is therefore good enough for a power user system, and it's reasonably priced too. For high-end gaming, though, you're going to be a little disappointed, and you'll need to consider spending more.



▲ The Sapphire R7 240: £70 for a 4GB card

Mid-range Graphics Cards

EVGA GT 740 Superclocked 4GB

DETAILS

- Price: £80
- Manufacturer: EVGA
- Website: goo.gl/M6D8if
- Requirements: Spare PCIe slot, eight-pin connector, 400W minimum PSU



▲ Although a good performer, the EVGA GT740 does cost £80



▲ Still an okay graphics card

appear, on paper at least, to perform the same.

Speaking of performance, the benchmarks were marginally better than the previous R7 240. The 3DMark 11 benchmark scored 2,840, which is a better number for those after a decent mid-

range card, and it will undoubtedly run the likes of *Skyrim*, *Battlefield 4* and *Watch Dogs* perfectly well.

The Sapphire R7 240 and this card are similarly matched in terms of performance, but you'll find that this card is around ten

pound dearer than the R7. At £80 or thereabouts, it's a decent mid-range card. However, compared to the performance of the £99 EVGA GTX950, it simply doesn't stand a chance.

As with the R7, though, the GT 740 performs extremely well as a non-gaming, power user graphics card. HD video content plays flawlessly, and picture or video editing are handled with ease. Perhaps, then, this is the perfect placement for this graphics card, as a dedicated GPU for a power user rather than something a mid-range gamer would have in their chassis.

This isn't a bad graphics card; we've certainly seen a lot worse. It's still within the £50 to £130 range we've set, and it can play some more modern games, but with some harsh frame-rate dips. As before, though, it's beginning to look its age, in terms of performance, and it will probably come to the end of its shelf life very soon. Otherwise, an okay card.



Asus R9 270X DirectCU II TOP

DETAILS

- Price: £130
- Manufacturer: Asus
- Website: goo.gl/cQHd0C
- Requirements: Spare PCIe slot, eight-pin connector, 450W minimum PSU



▲ The Asus R9 270X is quite a powerful mid-range card

This Asus model is at the top of our mid-range scale, and it's a performance card launched by AMD late in 2013. Since then, the prices have dropped significantly and the manufacturers have tinkered with its abilities, to hone it into a finely tuned piece of technology.

This model is based on the Curacao XT variant GPU, with a core clock speed of 1050MHz and a rather impressive GPU boost clock speed of 1120MHz, which is about 7% faster than the standard R9 270X. Furthermore, the 2GB of GDDR5 memory is clocked at 1400MHz, with a memory bandwidth of 179GB/s.

It has 1,280 shading units (or stream processors, as AMD likes to refer to them), 180 texture mapping units and a TDP of 180w. It's a full-sized, dual-slot card, drawing additional power from the pair of six-pin connectors. For this, though, you get glorious 2560 x 1600 resolutions from two DVI ports, HDMI and DisplayPort.

The 3DMark GPU score for this card was 8,670, which is a smidgen less than the EVGA GTX950. This means gaming is top notch when played through this card, as are the other more mundane duties of normal desktop use. Photo editing was problem-



▲ But it's the most expensive of the group

free, but rather oddly we did have some difficulties when it came to the video editing side of things.

The video editing test we ran used OpenShot to create a relatively small three-minute video, with a few transitions and a 3D animated title. It's nothing too intense, but as much as

an average user may get up to. For this, the other cards performed reasonably well, with the lower-powered cards taking a little longer to export the output and put it all together. The GTX 950 managed this in a blink of the eye, and even the lesser powered Sapphire R7 and GT740 did it a reasonable

time, but the R9 270X seemed to stagger through the entire test.

Playing HD video wasn't an issue, however, so perhaps there was something wrong with the drivers, since the hardware itself should be more than up to the task. Another problem was again the noise levels. While idle or performing normal desktop duties, the card was virtually silent, but when we first ran a game, it remained that way for about five minutes before suddenly deciding to increase the noise levels.

It certainly wasn't deafening, but it was a fair amount of noise, which required us to increase the volume of our speakers. As far as we could tell, though, the entire card was cool even when being benchmarked and gaming.

If you can take the noise levels and the gaming side of things is more your cup of tea, then Asus R9 270X is an excellent card. As far as the price goes, you can pick one up for around £130, but considering the EVGA GTX950 is slightly more powerful and £30 cheaper, you may want to think about your purchase.



Mid-range Graphics Cards

MSI R7 370 Gaming 2G Graphics Card

DETAILS

- Price: £115
- Manufacturer: MSI
- Website: goo.gl/DegCV1
- Requirements: Spare PCIe slot, 6-pin connector, 450W minimum PSU



▲ Another quality graphics card from MSI

Earlier in the year, AMD launched its new 300-series of Radeon cards, and MSI has been quick to move in with the launch of the R9 390X Gaming 8G, R9 380 Gaming 2G and the card we're looking at for this group, the R7 370 Gaming 2G.

The R7 370's GPU first appeared as the driving force behind the Radeon HD 7850, which was a pretty decent budget gaming card some years ago. The GPU was then resurrected for the R7 270 sometime later and is now once more resurfacing with a new lease of life in the R7 370.

The Pitcairn GPU isn't going to set the world alight with its performance, but it's a good enough processor to enjoy most modern gaming titles. With a core base clock of 1000MHz and core boost to 1050MHz, there's a reasonable amount of grunt in the old GPU to keep up with you. The 2GB of GDDR5 memory, with a memory clock frequency of 1425MHz is good too, as are the 1,024 shaders, 64 texture units and 182GB/s memory bandwidth. It's the baby of the new 300-series but good for gaming on a budget thanks to the £115 price.

As with most MSI products, the attention to detail is impressive, and manufacturing processes, as well as the components used,



▲ The performance to cost is pretty good too

● As with most MSI products, the attention to detail is impressive ●

are of the highest quality. The Twin Frozr V fans cover the large heatsink and three 6mm heat pipes. It may seem a little like overkill on a GPU that never really heated up all that much in the past, but it does offer peace of mind and greater potential for

overclocking for those who want to tweak the card.

To that end, the new Gaming App for the 300-series allows the user to fine tune the card to their own tastes. The three preset modes allow for silent running, a gaming mode for the best balance

between performance and heat, and an overclock mode that boosts the GPU and increases the speed of the fans. Within the app you'll also be able to control the LED effects and colours, as well as a few other tweaks here and there for balancing blue light and gamma adjustment for movies.

Connectivity for the R7 370 includes HDMI, DisplayPort, DVI-I and DVI-D ports. It's a CrossFire capable card, and you'll also find a single six-pin power plug at the end of the board. On the whole, then, a simple enough setup.

The emphasis, however, is clearly budget gaming. As we already said, the R7 370 will be able to play a wealth of current games on medium to high settings well enough, and depending on how demanding the game is, you might be able to get away with the odd instance of ultra-settings. Don't expect it to perform as well as its sibling 300-series cards, though.

In testing, it managed to score a respectable 8,702, which is slightly less than both the EVGA GTX950 and the Asus R9270X, but still a good score for a card that's a tad over £100 pounds.

The MSI R7 370 Gaming 2G is a good mid-level graphics card, but again we've seen more performance for less cost.



Zotac GT 730 Zone Edition

DETAILS

- Price: £52
- Manufacturer: Zotac
- Website: goo.gl/8Cqhdq
- Requirements: Spare PCIe slot, 300W minimum PSU

This Zotac entry is at the very bottom of our budget range. Coming in at around £52, it's certainly a value card, but is it actually worth it, or should you be saving up a little more for something different?

The Zotac GT 730 has 2GB of GDDR5 memory and is built around the GK208 GPU, as released by Nvidia in June last year. The actual clock speed of 902MHz hasn't been upped by Zotac on this model, but the memory clock has seen a significant boost from the stock speed of 1253MHz to 1600MHz on this model.

You'll also find 384 CUDA cores, a TDP of 49W and, in terms of connectivity, the Zotac GT 730 manages a perfectly fine DVI, HDMI and VGA output.

It's passively cooled, with a large, angled heatsink bearing the Zotac name fitted to the rear half of the card. This is a low-profile card, measuring 111 x 145 x 15mm, making it an ideal dedicated graphics solution for a media centre PC or a smaller chassis.

For the group benchmarks, the Zotac GT 730 didn't quite hit the higher-end numbers we've seen from the EVGA, Asus and MSI cards, but it did manage a 3DMark 11 score of 2,790. Although not great, that does put it above the Sapphire R7 240's score of 2,650.



▲ The Zotac GT 730 is a cheap and reasonably well performing card



▲ It's not the best gaming card, but for £52 it's good for the average user

“ It doesn't spring to mind if you're planning on a building a gaming system ”

This obviously means you won't be able to get the higher range of graphical splendour from more recent games, but you should be able to play some older titles well enough.

If gaming isn't your thing,

don't worry too much. HD media playback, video and photo editing and other general PC duties worked well with the Zotac GT 730. In fact, it managed to respond to the video editing test better than the far more

expensive Asus R9 270.

In truth, the Zotac GT 730 is a pretty basic graphics card, and it's certainly doesn't spring to mind if you're planning on building a gaming system. But taking into consideration that it costs the least in this group test by at least £20 and that it does perform reasonably well, it's not all that bad.

In the end, it really comes down to what you want from a graphics card. If it's all-out gaming performance on a budget, then the EVGA GTX950 is the one for you. If you want a decent card for video playback and other such duties and you don't want to break the bank getting it, then the Zotac GT 730 will deliver the goods.

In short, a good graphics card that's cheap and reasonably cheerful.



EDITOR'S
CHOICE

**micro
mart**



EVGA GeForce GTX950 FTW 2GB

Fantastic performance and a good price mean that this week's winner is the EVGA GeForce GTX950 FTW.

Considering this is a mid-range card, there's plenty to like about it, and it's more than enough for modern games running at a decent graphical level.

HIGHLY
COMMENDED

**micro
mart**



MSI R7 370 Gaming 2G Graphics Card

Close on the EVGA's heels is the MSI R7 370. The performance is a little behind but only just, and it's only £16 more too.

If you're not a fan of Nvidia-based GPUs, then this AMD-driven model may well be the one for you.

How We Tested

Each card was fitted into a PC with the following specs: Core i7-4790K quad-core 4GHz CPU, Gigabyte Z97M-DS3H motherboard, Samsung 120GB EVO SSD, 16GB Kingston HyperX Fury Red RAM, 750W PSU and an Aerocool Dead Silence Cube. For testing we used OpenShot with a three-minute video, complete with transitions and a 3D animated intro. We also ran basic desktop programs, (Word and Excel), Gimp for image editing, and for gaming, we used 3DMark 11 benchmark testing.

	EVGA GTX950 FTW	Sapphire R7 240 4GB	EVGA GT 740 Superclocked 4GB	Asus R9 270X DirectCU II TOP	MSI R7 370 Gaming 2G	Zotac Gt 730 Zone Edition
Price	£99	£70	£80	£130	£115	£52
Dimensions	256 x 111 x 40mm	145 x 95 x 15mm	111 x 152 x 38mm	271 x 133 x 40mm	258 x 132 x 37mm	111 x 145 x 15mm
Gpu Speed	1203MHz	730MHz	1085MHz	1120MHz	1000MHz	902MHz
Memory Speed	1653MHz	900MHz	1250MHz	1400MHz	1425MHz	1600MHz
TDP	90W	30W	64W	180W	110W	49W
Outputs	DVI, HDMI, 3x DisplayPort	VGA, HDMI, DVI	Mini HDMI, 2x DVI	HDMI, 2x DVI, DisplayPort	HDMI, DisplayPort, 2x DVI	DVI, HDMI, VGA
Slot Type	Dual	Single	Dual	Dual	Dual	Single
3DMark 11 Score	8,732	2,650	2,840	8,670	8,702	2,790

Top 5

Things We Learned From Black Friday

A few lessons that only rampant consumerism can teach us...

1 Friday Lasts All Week

And the week before. And the week after. The whole idea of Black Friday is that it's a sales period that comes after Thanksgiving, an American celebration that has nothing to do with us, and now we can't even stick to the day that's actually in the name. Instead, retailers declare long in advance that 'Black Friday lasts all week!', then when the Friday in question arrives, 'Black Friday lasts all weekend', and then when it's over, we're told it's Cyber Monday. No doubt we'll soon be told that it lasts all week, then retailers will probably just give a special name to every day of the year, all with the explicit intention of making people spend money they don't have.

2 A Lot Of Deals Are Rubbish

Even though we're more than a little cynical about this whole thing, we're not going to let our cynicism stop us from getting a bargain, so we still peruse various shopping sites to see if anything takes our fancy. A lot of the time, however, the 'amazing' deals that are promoted are frankly terrible. There were some decent discounts this year, as well as some more modest ones, like £10 here and £20 there, but what we noticed was that a lot of things weren't actually cheaper than they are normally. In fact, many of the big 'discounts' were entirely fabricated, with the quoted pre-discount price being either an RRP or a price that was slowly inflated beforehand in preparation for the sales.

3 It Seems A Lot More Civilised This Year

One thing we like about the spreading out of Black Friday is that people aren't so inclined to rush out to shops or head online all at the same time. This year, there were no news reports of people pushing over pensioners or children to get to games consoles, and none of the big retail websites crashed under the load of bargain hunters visiting them. Things instead were much more sedate, and that's far more preferable. We suspect, also, that a lot of people are staying away because they know the entire idea of Black Friday is in fact a bit of a con. Well, we did say we were cynical.

4 Self Control

For all our cynicism, we do admit there were some genuine deals to be found, but then the problem for us became not taking retailers up on every single bargain we could find. But with the right combination of deep breathing, relaxation and constant checking of our bank balance, we were able to stop ourselves from buying 12 Android tablets we didn't need just because they were cheap. As a result, we managed to retain the cash we'd put aside for other slightly more important things like food and heating. On the downside, you can't play Words With Friends on a loaf of bread.

5 Wait For January

For us, Black Friday isn't really necessary. We've had a traditional sales period in the UK for many years already, and it takes place in January. Whether or not the deals at this time are any better than Black Friday is up for debate, but we're not convinced we need the latter. And by sticking with the January sales and avoiding Black Friday, maybe we can convince retailers that we don't need to copy American ideas and that we're not interested in buying stuff we don't need just because a tenner has been knocked off a price that they never charged in the first place.



▲ Coloured paper bags: £10 each (normally £100)

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The \$5 Raspberry Pi

David Briddock
investigates the Pi Zero,
the latest addition to
the Raspberry family

On 26th November, the Raspberry Pi Foundation announced a brand new addition to the Raspberry Pi family, the \$5 Pi Zero.

Unsurprisingly, with such an amazing price, the news went viral around the web within hours. Major partners had already had received their full stock quotas, but these were never going to satisfy the insatiable demand, and it was sold out within hours.

Yet there was more ground-breaking news. The printed version of the Foundation's MagPi magazine, which appeared on the same day, had a Raspberry Pi Zero attached to the front. Yes, you read that right. A technology magazine with a computer as a free gift!

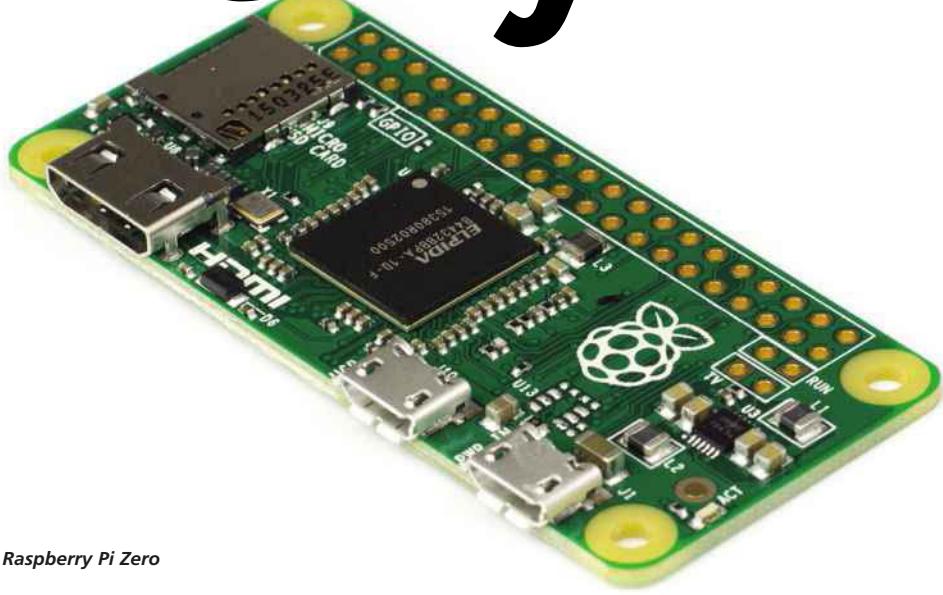
Zero Concept

Back in February, we covered the introduction of the Pi 2, a more expensive but far more powerful addition to the Raspberry Pi family, so why build a new entry-level board? Well, it's an interesting story.

It all came about during a meeting between then Google CEO Eric Schmidt and Raspberry Pi Trading CEO Eben Upton. During their discussions, Upton disclosed to Schmidt that the Foundation was going to build the Raspberry Pi 2.

But Schmidt wasn't impressed. In fact he said it was "A ridiculous idea". In his view the key to success was, "To try and be as close to free as possible." Experience had taught Schmidt that it is very hard to compete with cheap – and even harder to compete with free.

Of course, the Raspberry Pi 2 still appeared, and it's been just as successful as any of the previous Pi models. However,



Raspberry Pi Zero

“Don’t be fooled by that low price. The Pi Zero is a fully functional computer on a board”

in the background, the team was hard at work designing lower-cost members of the Raspberry Pi family.

The first iteration of this plan appeared as the \$20 Model A+, but in secret, a much more aggressive push was underway to build an even cheaper entry point Raspberry Pi.

The \$5 Challenge

The brief was straightforward. Take the Raspberry Pi Model A as a reference point, then make it as cheap and as small as possible, while maintaining the same specifications.

This tricky challenge fell to principal hardware engineer Mike Stimson. As Stimson had only joined the team earlier this year, the Raspberry Pi Zero project was a formidable initiation. A true rollercoaster ride, with peaks of joyous enthusiasm and troughs of deep scepticism.

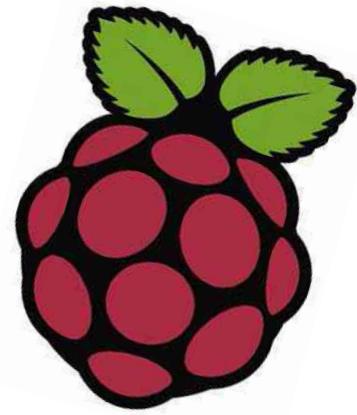
Some of Stimson's cost reduction tricks included a slimmer, single-sided circuit board, clever connection routing and denser component layout. Another key was the amazingly competitive volume manufacturing quotes offered by the Sony plant in Wales.

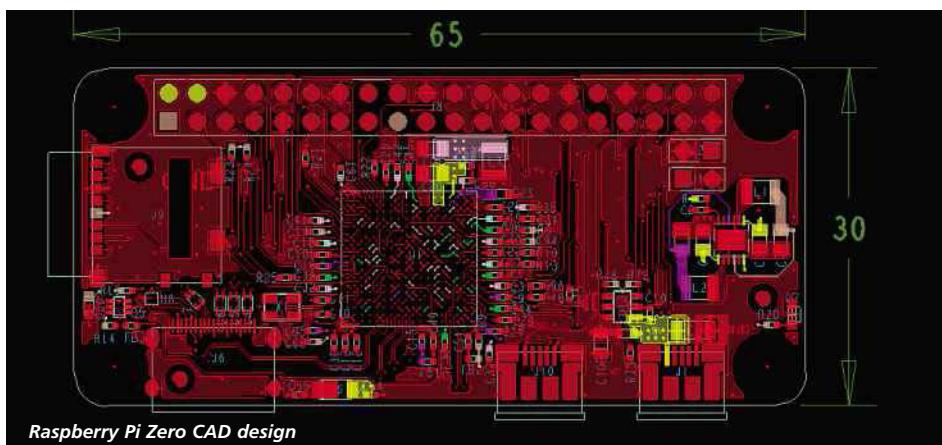
The whole process took just six months (for comparison, the original Pi took six years, and the Pi 2 two years). Manufacturing started on 27th October, with the first 10,000 boards earmarked for the MagPi magazine.

Fully Functional Computer

The Raspberry Pi Foundation's mission has always been to get more people interested in computer programming. There's no doubt a \$5 (or £4) Pi will help this cause, and as Upton said, "We really don't think we're going to get any cheaper than this."

Yet don't be fooled by that low price. The Pi Zero is a fully functional computer





on a board (see specifications boxout). As usual, it's powered by the impressive Broadcom system-on-a-chip, and the GPIO connector works with all existing 40-pin add-on boards, including the popular Pi HATs.

Yet the 1GHz ARM11 core is actually 40% faster than the Pi 1 models. This means the Pi Zero easily runs the latest Raspbian Jessie operating system, which includes the Scratch, Python and Java programming languages, plus a hackable version of the *Minecraft* game.

As for ports, there's a mini-HDMI, micro-SD and two micro-USBs, one for power and one for data. To keep costs down, the 40-pin GPIO and composite video headers are pinless, but these can be added at a later date. In fact, a Pi Zero Adapter Kit, with mini-HDMI to HDMI and micro-USB to USB converters

plus the GPIO pin header, is already on sale for just £4.

Gift To Education

The educational community will find it impossible to ignore a \$5 computer. Overnight the cost of equipping a whole class with Raspberry Pi boards has been slashed. Just £100 buys a lot of Pi Zero hardware.

With such a low price, it will be viewed in a similar light to the BBC Micro Bit, a free mini board due to be given away free to one million schoolchildren, but the delayed Micro Bit won't now appear until next year. Even then, it's a fairly limited hardware hacking board.

However, add a keyboard, mouse and monitor to the Pi Zero and it instantly becomes a PC. Then you could plug a BBC Micro Bit into its USB data socket.

Cautious Launch

There's no doubt the whole Pi team is delighted by the technical feat they've accomplished and the attractive aesthetics of the Pi Zero, and who can blame them? Even so, on launch day, they seemed rather cautious about the success of the Pi Zero, with Upton saying, "I just hope people like it." The launch plan involved building 100,000 boards. Only then would a decision be made what to do next.

But cast your mind back to the original Raspberry Pi launch in 2012. At the time, Upton believed the diminutive boards would be mainly bought by academic institutions and expected to sell around ten thousand, at most. A little over three years later, sales figures have reached 250,000 a month.

The Pi Zero is already a huge success story. Within 24 hours of the launch, every one of those 100,000 boards had disappeared off the shelves, and with such huge worldwide appeal, new stocks will sell just as fast as they can be manufactured.

What's Next?

The Pi Zero is undoubtably a bold move, but is there more to come? As we've already mentioned, the Pi Zero is actually more powerful than the Pi 1 models, so maybe they'll be a shake-up of the Raspberry Pi family lineup (see boxout), something along the lines of a \$10 Pi 1 is suddenly a distinct possibility.

We'll have to wait and see, but one thing's for sure: the Raspberry Pi phenomenon continues to go from strength to strength. [mm](#)

Raspberry Pi Zero Specs

- BCM 2835 processor
- 1GHz ARM11 core
- 512MB of RAM
- Micro-SD port
- Mini-HDMI port
- Micro-USB for data
- Micro-USB for power
- 40-pin GPIO connector
- HAT add-on compatible

Raspberry Pi Family

- 2012: Pi 1 Model B (\$35)
- 2013: Pi 1 Model A (\$25)
- 2014: Pi 1 Model B+ (\$25)
- 2014: Pi 1 Model A+ (\$20)
- 2014: Pi Compute Module (\$35)
- 2015: Pi 2 (\$35)
- 2015: Pi Zero \$5 (\$5)



How Do Free Apps Make Money?

Ever wondered how apps you don't have to pay for possibly turn a profit? Rob Leane did some digging to find out...

Unless you've somehow still managed to avoid the smartphone revolution, apps probably play a fairly large role in your life. They can help keep you on top of a hectic work life, monitor your fitness, keep you in touch with far-flung friends and family, predict the weather and keep you entertained for endless hours.

Curiously, though, the best ones are often free. If you're a thrifty type, you can collect all the services listed above on your mobile or tablet without shedding an extra penny. How does that work, then? Like me, you might have wondered whether any of these apps make any real cash.

Well, as it turns out, they do. As a high-end example, statistics from May 2014 tell us that the free-to-download mobile game *Clash Of Clans* rakes in around \$167,000 on an average day from America Apple device users alone.

From the same crowd of Apple users, Skype apps – also free to download – draw an income of \$25,000 a day. If you were wondering, those stats come from the app marketing website *ApplnTop.com*, which collates data from the American App Store. They are legit numbers.

Here are the ways in which apps like these make their money...

In-app Purchases

It's no secret how free-to-download games like *Clash Of Clans* and *Candy Crush* turn a profit. It may be free to get in the door, but once you're in there are plenty of other ways to give the developers your money: buying items, upgrading your character, unlocking new levels and so on. These are often known as microtransactions or in-app purchases, and they're hardly a new occurrence.

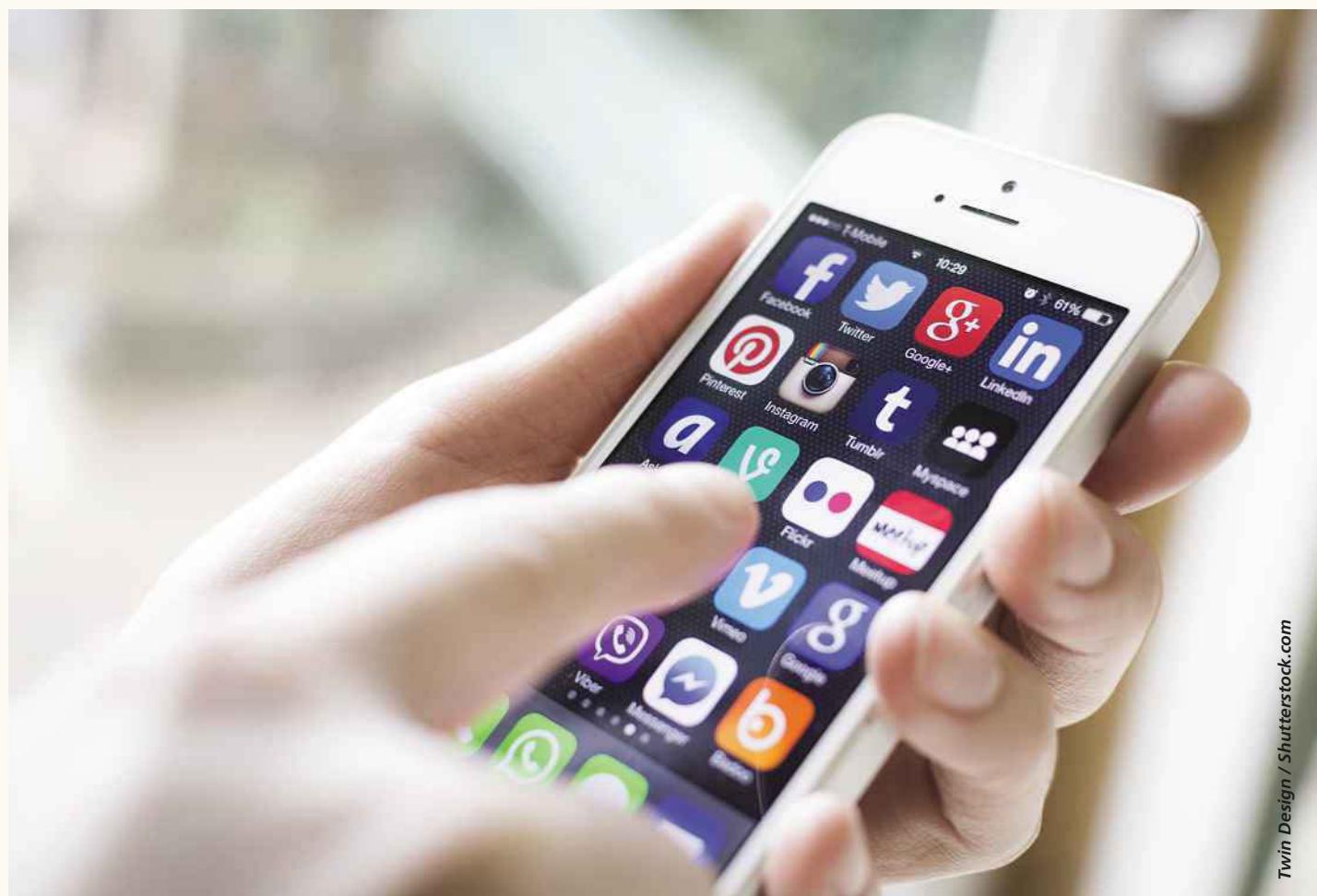
Although they'd been around for years beforehand, the in-app purchase made its biggest leap in prominence around June 2011. The mobile analytics company Flurry noted that in the six-month period from January to June of 2011, the origin of revenue garnered by games in the Apple App Store made a significant shift.

In January, only 39% of the overall income for games purchases came from in-app transactions. By June, though, that number had jumped to 65%. The majority of money being spent on games was now being spent on in-app purchases rather than buying the game itself. Put simply, the microtransaction was beginning to overtake the traditional pay-per-purchase model.

“ Clash Of Clans rakes in around \$167,000 on an average day from America Apple device users alone ”

In 2014, the numbers had shifted even more significantly. Another analytics company, Distimo, noted that microtransaction purchases represented 92% of all revenue in the iOS App Store and 98% on Google Play.

In some corners of the gaming world, this is a cause for frustration. By building in an in-app payment element, 'free' games



Twin Design / Shutterstock.com



can become virtually impossible to complete without forking out cash on a regular basis. The term 'play to win' has cropped up on more than a few occasions.

Some games will offer you a choice: wait a specified amount of time before continuing or pay a quid or two to progress now. For the more impatient type, this can become a dangerous way to lose a lot of money.

Indeed, there have been a few news stories over the years that point out the frustrations with this model. Every now and then, you hear a scandalous story of a young child borrowing a parent's phone and unknowingly splurging significant amounts of cash.

But there's no denying that the model works from a business perspective. On top of the number we listed for *Clash Of Clans* earlier, here's one other statistic you might shudder to read: in 2013, the free-to-download sweet-swiping sensation *Candy Crush Saga* raked in a whopping \$1.5 billion.

Advertising

None of us enjoy seeing obtrusive adds on our mobiles and other assorted devices, but it happens all the time. That's because it's a big money spinner. In April 2012, the Interactive Advertising Bureau revealed that \$.1.6 billion was spent on mobile advertising in 2011. That number will only have increased since then.

Nothing's more appealing to an advertising agency than knowing they can stick something attention grabbing right under someone's nose. With mobile app advertising, you get the added bonus of knowing that your targeted buyer is already interested in games, music, movies or whatever it is you're selling.

Compared to online advertising, in-app advertising was small business in 2011. \$31.7 billion was spent on online adverts for the exact same reason listed above. Using the internet's groundswell of shared information, advertisers can pick their audience out using a very specific criteria. It's a bit creepy, but it's big business.

Studies confirm that app developers depend on this money to keep afloat. A 2012 Cambridge University study showed that 73% of apps in the Android marketplace were free, and 80% of them relied on advertising revenue as their main source of income.

Ads in apps take all sorts of forms, from little banners along the top or bottom of the page to massive screen-filling pop-ups complete with animation and audio. These can be irritating, especially if you're trying to limit your data usage. Still, you can't deny the need for businesses to make money. With games, it's often a throw-up between paying to download, forking out for in-app purchases or putting up with obtrusive advertisements. It's a case of personal preference which type of game you choose to download.

Flappy Bird is an example of an addictive game that benefited hugely from advertising income. The game was a viral sensation,

with more than 70 million downloads across the App Store and Google Play. As a result, the app was raking in \$50,000 per day (according to stat that its creator, Dong Nguyen, gave the *Verge* website) around the time of February 2014. If you wanted proof of how lucrative selling advertising space can be for a developer, there you go. Going by those numbers, Nguyen would have been making a million dollars every 20 days. Yikes.

Apps with adverts have come up with another way to make money from the system too. And it's a stroke of business genius, when you think about it...

Premium Services

A cunning way that free apps make money is by encouraging you to upgrade to the premium service. A notable one of these is Spotify, where you can happily stream from a vast library of music, with adverts after every few songs, without giving it a penny.

But if you want to listen to songs while offline or skip the adverts, you'll have to fork out for Spotify Premium, which costs £9.99 a month here in the UK. This model, making money from ads and artists, has earned Spotify a 2015 valuation of \$8 billion.

“A cunning way that free apps make money is by encouraging you to upgrade to the premium service”

Games often play at this sort of strategy too, letting you play for free, but tempting you with the option to sign up as a paid member to get rid of the annoying ads. Whichever option you choose, the game makes money.

This way of making money enables free apps to promote paid version of themselves. They draw you in with the free version and hope that once you're hooked you might pay to enjoy them without the adverts. The product they're selling hasn't changed, but one way they make money through advertising and the other way they make money through you.

Zynga, the company that makes word games like *Words With Friends*, *Farmville* and many more – is an expert in deploying this method. To be fair, it uses adverts and in-app purchases too, but it sells premium versions of almost every game it makes – some for extra features, some to just ditch the ads.

Employing all these methods has certainly worked for Zynga: the company made a net income of \$225.9 million in 2014 alone and has an estimated \$2.3 billion's worth of assets.





Spotify

Tinder, the free-to-download dating app from the company behind Match.com, with an estimated user base of 50 million people, launched a premium service in March 2015. Tinder Plus allows you to tell an infinite amount of potential romantic partners that you fancy them each day (the free version now has a daily limit on 'swipe rights').

Cruelly, if you're over 28, you now have to pay more per month to find love (£14.99 a month, compared to £3.99). Despite this meanness, the decision to introduce a premium service paid off for Tinder. By May 2015, the app had leaped from 969th in the Apple App Store's revenue leaderboard to 26th. That's not bad going at all, by anyone's books.

Sponsorship

Another way that free apps make money is through sponsorship. Essentially the ultimate advertising contract, a sponsorship deal will see a company swoop in with a big offer to plaster their name all over the app in question. This can often happen if a company and a specific app have a shared target market. While reading up on this, I came across the words brand, partnership and synergy rather a lot.

Although you couldn't technically call it a free app (you can only use it free for a month before buying in), the productivity app Evernote is the master of sponsorship deals.

If you're unfamiliar, the basic idea of Evernote is that it lets you organise your life in intricate sections. Meeting minutes, scribbled-down notes, important images; Evernote helps you store and arrange them, as well monitoring your on-going projects, to-do lists and outstanding tasks. Essentially, it's an app for busy business people who need to keep track of a lot of things at once.

In 2013, Evernote hatched a deal for an undisclosed fee with 3M, the company that invented the Post-It Note. Evernote came up with a snazzy way to incorporate Post-It Notes into its app (you photograph the real ones and they pop up on your PC in digital form), merging the brands and presumably earning a big wad of cash for the developer.

Since then, it's signed sponsorship agreements with notebook company Moleskine and online CV database LinkedIn. All these companies are targeting the same business community as Evernote. The companies get their name and product under the right noses, and Evernote reaps the profits.

Games aren't immune from this type of deal, either. For example, in the period around the 2012 Super Bowl in the United States, the sandwich chain Subway brokered a deal to become the national sponsor of the popular mobile game *Pre Play Sports*. This free-to-play app allows American football-loving gamers to earn points by predicting every moment of a match as it goes along. Subway presumably paid decent money to plaster its branding all over the app at its busiest time of year.

Another free-to-download app that has benefited from a big sponsorship deal is the weather app AccuWeather. Courtyard by Marriot, a hotel chain, paid to be the 'launch sponsor' when AccuWeather launched a new iPad edition of its app in 2012. It's another example of a company shelling out to an app to exclusively get its product on the right audience's radar.

Admittedly, sponsorship deals are more for the high-end established apps than the just-starting-out indies. Evernote and *Pre Play Sports'* successes signify another path to cash, though: if an app becomes successful enough in its field, relevant brands will want to sponsor it.

CPI Networks

CPI stands for 'cost per install', and the basic idea here is that of a network where apps advertise each other using pop-ups. Two such networks are Chartboost (founded in 2011) and Playhaven (founded in 2010), which both boast sizeable databases of developers who advertise one another in exchange for some dosh.

Every time someone downloads your product because of an advert (which they saw pop up on another app), you have to pay a pre-agreed fee to the app that hosted the advert and helped you find a new customer.

Likewise, if an advert that popped up on your own app prompted someone to install a different app, they pay you. As a hypothetical example, a developer might go to Chartboost or Playhaven offering \$5 per install that their network can provide. Every time an advert on your app closes the deal, the network gives you a cut of the money they've made.

It's a 'you scratch my back, I'll scratch yours' philosophy that has been going on for a while in the world of online marketing. Websites promoting each other as part of a big network (they're called CPA networks – 'cost per acquisition') is nothing new, but instead of installations, they'll be after clicks, forms filled in, newsletter sign-ups or whatever other metric they have for success.

As an example of how wide-ranging a CPI network can be, Playhaven's website claims that it has more than 18,000 games on its roster. Through these, it can reach 254 million monthly users. Between them, those users will launch five billion gaming sessions per month.

Chartboost is even bigger, with 200,000 games on its network. These games have over 700 million monthly active players who clock in with approximately 20 billion gaming sessions a month.

As resources, it's not hard to imagine how these two sizeable networks could help a free app both make money and source new users. They may not make much money per installation, but it surely adds up if your product is worth selling and has a strong advert in place.

Final Thoughts

So although you may not have paid for many of the apps on your phone or tablet, there are plenty of ways in which those apps and their developers will be making money.

Some customers will sign up for premium services, agreeing to dole out monthly or yearly to use an upgraded version of their app of choice. Other users may not be too frugal when it comes to splashing out on in-app purchases to enhance their experience.

And behind the scenes, advertising is offering various different ways for developers to pile up a few pennies. Selling ad space or nabbing a hefty sponsorship deal is one way to do it, or a developer could choose to join a CPI network and work with other apps to cross-promote each other and share the profits.

One thing's for sure, though: successful free apps are unlikely to be short of revenue streams. If you have enough users, there are plenty of ways to make to money. **mm**

Code With AI2

Discover, Share And Sell

Discover the AI2 community and submitting apps to the Google Play store with David Briddock

During this series we've built a wide range of Android apps with App Inventor 2 (AI2). And by now you may have created some Android apps of your own.

To round off this series, we'll look at what's available in the AI2 community and find out how to make money from an app by publishing it to the Google Play store.

What We'll Learn

The App Inventor community has been growing ever since Google released the original App Inventor. The latest browser-based AI2 version from MIT has only boosted interest and support from app builders, teachers and education establishments.

This week, we'll discover how to import community created apps and how to share our coding creations with others. We'll also learn what's involved in publishing to the Google Play store as a free-to-download or paid-for app.

Example Projects And Apps

A great way to uncover AI2 coding tips and tricks is to locate and download projects created by others.

At appinventor.org, there's a large collection of learning and teaching resources. It also has a useful collection of Android app examples.

These example apps are broken down into small, annotated construction steps – often with a short video tutorial. Supplementary information includes PDF-format documentation, the AIA source file and the APK Android package file.

“ Making money from your app is an appealing concept ”

The AI2 support pages (goo.gl/Qpe8Dw) also offer many helpful coding insights.

As for community-created apps, simply click on the Gallery option in the green AI2 menu bar. Here you'll find a web page with Recent, Featured and Popular app categories. Use the manual Search option to discover projects that are related to your own ideas or interests.

Sharing Your Project

Once you've created a useful app, you might like to share it with family and friends. One way is to create an AIA source file, then send it as an email attachment. After opening this email, the attached file can be imported into the AI2 tool.

However, most people will just want an installable app, so another option is to generate an APK Android package file with AI2, then attach this file to an email. The recipient can then side-load this .apk file onto an Android device (goo.gl/ZMKgAe).

However, by far the easiest place for anyone to install your app is the Google Play store. Unfortunately, there are quite a few steps involved in submitting apps,

especially if they're going to become a financially successful.

Here's a basic summary of the publication tasks you'll need to perform.

Google Play Assets

First, there's the Google Play app asset information. Obviously, this includes the APK package file. To be accepted, the file must be no more than 50MB in size, which shouldn't be a problem as the apps we've created in this series are only a few megabytes each.

The app's title needs to be both unique and memorable. It's also very important to manage the version code and name (set in the Screen1 component properties), which will increment for every minor or major app enhancement.

General app information includes a comprehensive description of the app, the genre, the category and sub-category, the specified language (if not US English) and some developer contact information.

Additional app store assets include at least two app screenshots, a high-resolution app icon image (512 x 512 32-bit PNG), a promotional graphic (180 x 120 24-bit PNG) and a feature section graphic (1024 x 500 24-bit PNG).

Optional extras, which may greatly boost your download figures, include a YouTube video link.

Setting A Price

If your app isn't free, you'll need to decide on a price, which will be from \$0.99 upwards. The price you choose is a balance between the potential number of sales versus gross profit. Selling 25 copies of a £5 app is, in the end, nowhere near as profitable as selling 1,000 copies of a £1 app.

In the beginning, the goal is to attract as many buyers as possible. When you've created a developer reputation for quality apps and have a loyal customer base, there'll be more scope for higher profit margins.

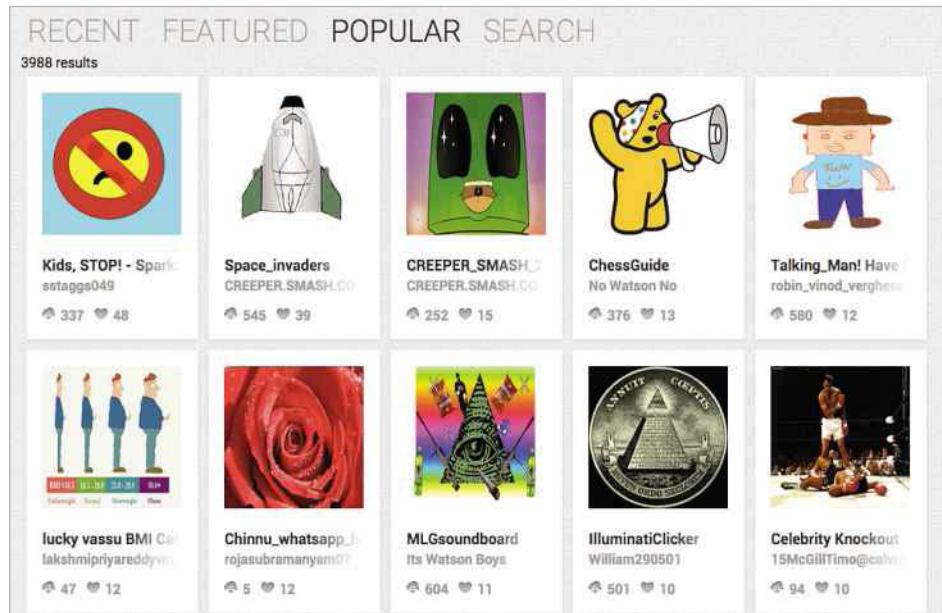
Submission Process

To begin the submission process, you'll need to sign up for a Google Play store account via the Google Play Developer Console website (see Links boxout). You can specify the same Google account you used for AI2 development.

The Developer Console is the home for your Google Play store app publishing operations and tools. Here you'll find the status of all your published apps, including the number of installations, app ratings, bug reporting capture/feedback and financial reports.

Useful Links

- **MIT App Inventor:** appinventor.org
- **Google Play store:** play.google.com
- **Developer Console:** goo.gl/hqCG7F
- **Developer Console Info:** goo.gl/u4bxNi
- **Google Play Publishing Home:** goo.gl/bYJa4o
- **Developer Registration Help:** goo.gl/5ne2wE
- **Developer Help Centre:** goo.gl/zrBM6M



▲ AI2 App Gallery

A screenshot of the Google Play Developer Console. At the top, it shows 'Google play' and 'Developer Console'. Below that is a navigation bar with 'All applications', 'Financial reports', 'Settings', and 'Announcements'. The main area is titled 'ALL APPLICATIONS' with a '+ Add new application' button. It lists two apps: 'Animal Translator 1.1' (Free, 12,078 installs, 3.29 rating) and 'Earthquake! 3.8' (Free, 71,426 installs, 4.15 rating). The bottom right corner shows 'Page 1 of 1'.

▲ Developer Console example

You'll need to enter basic information about your developer identity, such as name, email address and so on (which can be modified later). Then accept the region-specific Developer Distribution Agreement, and you'll need to pay a one-off \$25 USD registration fee using Google payments.

Other elements include registering for a Publisher Account and, if your app isn't free, setting up a Google Payments Merchant Account.

For full details of the steps involved, visit the Google Play Publishing Home website (see Links boxout), where you'll find references to other developer-focused publishing and deployment information.

Selling Your App

As you can see, there's quite a bit involved in submitting your first app. However, most of these steps only have to be done once. Then you'll just use the Google Play Developer Console to upload new apps or release updated versions of existing ones.

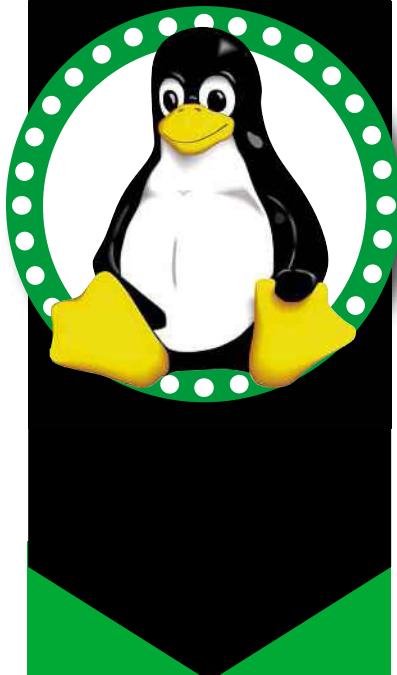


Making money from your app is an appealing concept. App prices on Google Play store are quite low, typically a few pounds at most. However, with over 1.5 billion Android devices in circulation, the revenue earning potential of a popular app is enormous.

Of course, it's not quite that simple. Any new app has to compete for attention with the hundreds of thousands of existing apps on Google Play. To make reasonable amounts of money, you'll have to deliver something different, innovative or technically superior to what's already on offer.

Obviously that's quite a challenge. But many have done it before. Successful home-based app builders earn a useful second income or can even focus on app development full-time.

With the right idea, AI2 and a little good fortune, you might just hit the app revenue jackpot. Good luck. **mm**



David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

Linux

Raspberry Pi Zero

A new Pi at a new price

By the time this week's Linux News goes on the shelves, the Raspberry Pi Zero will have well and truly taken the world by storm and probably totally sold out. It's hardly surprising really, the Raspberry Pi team seem to have had the Midas touch ever since the original Pi was launched some years ago. What will make the new Zero such a sought after product, though?

Zero Specs

The Raspberry Pi Zero is launching with a single core 1GHz Broadcom BCM2835 ARMv6 SoC processor, which is capable of playing back full HD media content. It comes with 512MB of memory at 400MHz, a single micro USB port, 5v micro USB power input, mini HDMI, a microSD card slot and the familiar 40-pin GPIO. It doesn't, though, have an Ethernet port.

The Pi Zero is, according to the Raspberry Pi Foundation, 40% faster than the original Pi model, and the GPIO layout is the same as the model A+, B+ and 2B. What makes this such a special addition to the Pi flock though, however, is the fact that it measures just 65 x 30 x 5mm. Oh, and it only costs £4!

A No-IOU CPU

If the original Pi, at £25 (or whatever it was) seemed unfeasibly cheap for a fully-blown Linux powered computer, then £4 is enough to make even the most Scrooge-like of individuals consider dipping into their pockets. Naturally since the Raspberry Pi Zero is essentially the first Pi, but smaller and slightly more powerful, you can do pretty much everything you did before with it. That means all those interesting projects that the Raspberry Pi became famous

Jessie Lite installed, running at a meagre 65mA. And with the HDMI port and ACT LED disabled, the power dropped to just 30mA. This drastic drop in power will be music to the ears of those who want a remote Pi in the field with a minimal solar charger setup.

What Next Then?

There's little chance that the Raspberry Pi Foundation is going to stop here. What we'll see next from the team is a mystery, but you can be sure

66 The Raspberry Pi Zero is
essentially the first Pi, but
smaller and more powerful 99

for could now be altered slightly to accommodate a smaller and lighter board.

Amazingly, the Pi Zero can have certain hardware and software elements disabled (I think the other Pi's are capable of this too – but I've not tried it) to save even more power. One user reported a Pi Zero with just the micro SD card slot and ACT LED active, with Raspbian

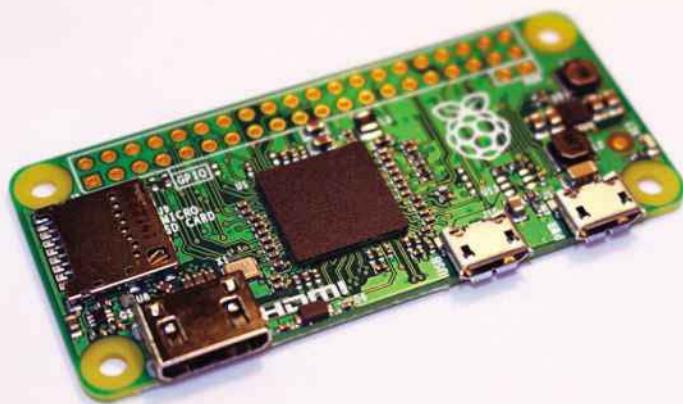
that whatever will be released from it will fly off the shelves at a fairly rapid pace.

It got us thinking though, with all this processing power in something as small as this – and in the modern smartphone too – what could we be looking at in just another five years' time? And, since Linux is the key to helping to drive all this tiny technology, where will it be in five years?

Perhaps the race to populate the desktop with Linux was the wrong battleground to fight. The race for small technology projects, smart devices and such has already been won by Linux – and the software it's based on.

Anyway, we're interested in what you think. What next and what are you doing with your Raspberry Pi Zero?

◀ The Raspberry Pi Zero, just £4!



New Keyboards Vs Old Hands

Even tech as relatively simple as keyboards won't stand still – unlike the people who use them

You can often estimate how old someone is, purely based on their personal preferences and how they react to certain things. If a person uses the term 'gamepad', chances are they're younger than someone resolutely and stubbornly sticking to the term 'joystick', even though joysticks ceased to be the main input devices for gaming when the Commodore 64 shuffled off this mortal coil.

Less obvious, perhaps, but something I've noticed of late being a quite reasonable indicator of someone's age, is their response to keyboards. Quite often, people who grew accustomed to – and swear by – mechanical keyboards are rather greyer of hair and beard. They enjoy typing by hitting keys with the kind of force and venom that'd make the average person's fingers howl; and the keyboards emit so much noise co-workers frequently conspire to gleefully hurl said keyboards (and perhaps also their users) out of the window.

In recent years, though, Apple keyboards became sleeker and thinner. I remember when quite a few journo's threw toys out of prams when slimline notebook-style keyboards for desktop Macs arrived, with their thin, white keys poking out only a little above their sleek aluminium

bed. I personally loved the new keyboard and immediately bought one. When it arrived, I tore open the box and quickly found myself in typing heaven – the key travel was short and typing was almost effortless. The keyboard was responsive, and the unit was ergonomic, due to its low profile. I didn't understand those people, old of body or mind, who dismissed such a wonderful new accessory.

Then the iPad arrived. Its on-screen keyboard was, for a tablet, surprisingly non-awful. But that I use that term showcases how it never really gelled with me. How could anyone type on glass? Madness!

Then educator Fraser Speirs, instigator of the first school one-to-one iPad programme, told me his students have no problem whatsoever tapping away on iPad displays – and at speeds that would make you dizzy watching. To them, it's second-nature; to them, my 'futuristic' Apple keyboard is just as much of a relic as those mechanical keyboards people were (to my mind) bafflingly clinging to.

Given sales of the iPad not being stellar over the past couple of years, it's hard to know whether Apple still believes that device and platform is the future, but the company's doubling down somewhat with the iPad Pro. Apple CEO Tim

Cook said that device for a great many people could replace a notebook or PC, and although it optionally comes with a keyboard case, it can be used just like any other iPad.

To some extent, I wonder whether Apple's recent revamped keyboard designs are urging us towards this future. The new MacBook's keys feel alarmingly like typing on an iPad. And I'm writing this article on one of the new Magic Keyboards. Although it uses scissor switches, rather than the butterfly switches found in the new MacBook keyboard, there's a quite harsh response from the keys. It's not quite like tapping on glass, but there's an oddly dead feel to it all. There's none of the warmth and softness you get from the older Apple keyboard.

I'm determined to power through, though. After all, the new keyboard's profile is superior to its predecessor's, it has full-size function keys, and it's charged using Lightning rather than AA batteries. Apple finally thinks it's good enough to call Magic, like its other accessories; I wouldn't go that far, but I certainly don't want to come off like an old git either. My hair's grey enough as it is.

▼ *Apple's new accessories are all apparently 'magic'. Paul Daniels – and people who like mechanical keyboards – might disagree*



Craig Grannell is a writer, designer, occasional musician and permanent loudmouth. He's owned Macs since 1996, when Apple was facing certain doom, and is therefore pleasantly surprised by its current success. Find Craig on Twitter at @craiggrannell

MAG
IC



Ian is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

Mobile

Phones For Christmas 2015

Ian McGurren runs down his list for the best phone buys this Christmas

If there's a watchword in this year's phone list, it has to be value. Though it has threatened before, 2015 could finally be the year that value trumps all. Let's look at what's the best bang for your seasonal buck.

Up to £149

There's always a lot of cheap phones about, with both the new ones, as well as those from last year at reduced prices, but it has taken time for a variety of quality handsets to be commonplace at this price point. But this year, all the exciting action is in the bargain bins. The Moto G, now into its third version, is still a fantastic phone that has the Google Play device-edge over the competition, and at £149, is still good value. Note 'good', not 'amazing', as that's reserved for Vodafone's staggering Smart Ultra 6, a 5.5" octacore phablet that regularly hits the magic £99 price point and decimates all the Android competition around it.

£150 - £349

It's here we begin to see you don't get quite as much for your money, but you begin to get style and a known brand. Amazing as the Smart Ultra 6 is, some just want something a bit more attractive. Enter an old name: LG's G4, a flagship phone in 2014 that is still something of a beast now with its 5.5" QHD screen. Frequently popping up at just over £200 on sites and in shops alike, it's worth keeping an eye out for. Another old name now, but this time with a makeover in the Nexus 5X, a rather good

re-release of the rather good Nexus 5, taking what was great about the original and giving it a bump in specs. It is bigger, though not huge, and is one of the first Marshmallow handsets, ideal for those who want to live on the bleeding edge.

£350+

Despite the increase in the power of the budget ranges, the flagships show no sign in going away, and if you can afford it (or justify it), there are still some beautiful devices to be had. Top of the tree in design terms is arguably Samsung's S6 edge, a gorgeously handset hewn out of aluminium with more than a passing resemblance to another top end device, Apple's iPhone 6S. The difference here is the S6 is comparatively new, whereas the 6S is more a boost to last year's device. As Android handsets go, though, it is arguably the most powerful and most attractive.

Of course, not everyone wants Android, and for real tech heads, there's been one device that has been turning said heads recently, Microsoft's Lumia 950 (and 950XL). Well, that's not quite true, though the phones are superb examples of not just Windows Phone handsets, but phones in general, built as they are with a very powerful spec and a QHD AMOLED screen that brings that UI to life. What is turning the heads though is Continuum, Microsoft's way of turning a phone into a desktop Window 10 PC (with the addition of a tiny box and a monitor). It's quite possibly a game changer.

Christmas 2015 is a strange year; the expensive phones are difficult to justify in light of how good the budget ones are. You could actually buy someone a really good phone and still have money left over for more gifts. No doubt, there are some great handsets out there to suit every budget limit.



Whatever Happened To Matrox? Part Two

Andrew Unsworth checks out the state of Matrox's art

Last week I donned my 'I've-forgotten-everything-negative' spectacles and reminisced about the Matrox cards of old, such as the Millennium P650, which was the subject of the first review I ever wrote for our beloved *Micro Mart*. I also wondered what Matrox was up to at present. Although its cards were geared towards professional multi-monitor use, it wasn't that unusual for an enthusiast to have a Matrox card in the early to mid-2000s, as the cards were decent enough for gaming. Not the best, but they could certainly hold their own.

From the late 2000s onwards, Matrox seemed to stop appearing in the consumer press titles and websites, and its hardware output focused on solving the problems of industrial and professional customers rather than PC enthusiasts. This would seem a good idea, seeing as other card manufacturers were battling to become graphics king of the desktop PC, a battle that has since turned into a two-tribe war. By following a different path and playing to its strengths, Matrox could make money and stay in business.

So what hardware does Matrox produce now? Its output is split into three streams: graphics, imaging and video. The graphics stream is composed of external devices that let you

attach multiple monitors – up to three to a single-output laptop or graphics card (tinyurl.com/4ds2ve) – and graphics cards that enable output to multiple monitors. There are also keyboard, video and mouse (KVM) extenders that employ 10GB/s fibre-optic technology to deliver up to Ultra HD video, keyboard, mouse, USB and audio signals to a user up to six miles away from the host computer.

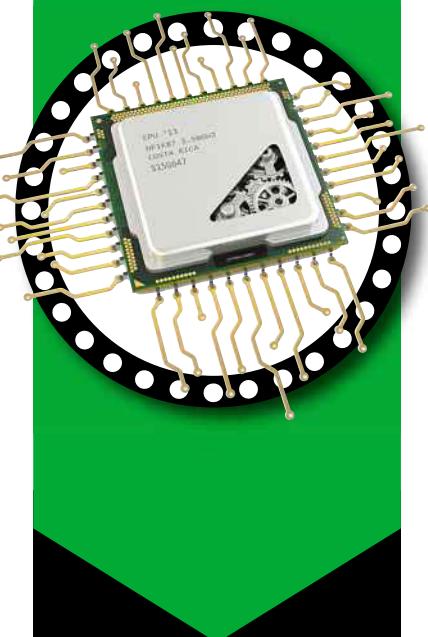
The KVM units are named AVIO, and users require an AVIO transmitter to send data from a remote computer and an AVIO receiver to receive that data. As Matrox says it's possible to send data across six miles, users shouldn't have a problem using the devices to route audio, video and peripheral data between floors of an office block. Matrox also claims that there's zero latency, so there's no waiting around for video or data, and none of the data is compressed.

The AVIO system isn't cheap, but this is to be expected given its niche market. At the time of writing, Insight (www.uk.insight.com) is selling an AVIO transmitter for £1,549 inc. VAT, while the receiver costs £1,567 inc. VAT. You'll also need to add the cost of fibre-optic cable on top of that. This may seem expensive to consumer eyes, but the ability to connect remotely to a very

powerful computer that's held in a climate-controlled and secure environment makes the £3,000 cost seem low. The Matrox AVIO kit is exactly the kind of thing I'd dearly love to test, but not having access to a skyscraper to make sure the devices can handle long distances means it'd probably be wasted on me.

Matrox's graphics cards are tiered in a set of ranges (tinyurl.com/62fk7o) starting with the P-series' fanless low-profile designs that allow the use of multiple monitors. Multi-monitor support is something we've come to take for granted with modern motherboards and graphics cards, but the low-profile and fanless design is a boon in systems where size and noise needs to be kept to a minimum. The C-series cards, meanwhile, are designed to route video to up to six monitors or projectors, and are intended for use in roles such as digital signage, AV studios and control rooms. Indeed, signage is one area Matrox seems to be targeting, and given the increase in large digital signs in places such as railway stations, stadia and city centres, it's a good idea to become the technological authority on it.

Matrox may not be the name that once was in consumer graphics, but it has innovated and made professional and industrial markets its own. It's good to see that it's still around.



Andrew Unsworth has been writing about technology for several years, he's handy with a spanner, and his handshaking skills are second to none

ENTERPRISE



Specialists



Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

Gaming



Retro City Rampage gets a sequel, with *Shakedown Hawaii* offering up a larger, more colourful city to explore

This week, Ryan checks out the forthcoming indie games *Shakedown Hawaii* and *Douglas Circumstance*, and looks at how League Of Legends is dealing with 'toxic' players...

Plug & Play

Fallout 4, *Black Ops III*, *Star Wars Battlefront*; as the end of the year approaches, most of gaming's big guns have already been discharged. What better time, then, than to look at a couple of smaller yet no less exciting games on the horizon?

First, there's *Shakedown Hawaii*, indie developer Vblank's sequel to 2012's *Retro City Rampage*. That game, you may remember, was an 8-bit parody of the *Grand Theft Auto* series, with its own amoral anti-hero working as a gun for hire in a bustling city. Lovingly crafted out of NES-era sprites, it also made joking references to *Back To The Future*, complete with a time machine that throws the entire story through a loop.

Shakedown Hawaii sees the story leap forward in time once

again, this time to the 16-bit era of consoles like the Mega Drive and Super Nintendo. Along with more detailed graphics (which really do look spectacular) the sequel now takes place in a much larger, free-roaming city, and the first trailer (youtu.be/jNmYyb7dCdQ) shows off the sequel's destructible environments. Will Doc Choc and his time-travelling phone booth be making a return? We'll have to wait and see.

Slightly less violent, but no less anarchic, is the side-scrolling platformer *Douglas Circumstance: Monster Extermination Company*. Like *Shakedown Hawaii*, it's brought to life with retro sprites, which might make some readers roll their eyes – there are, after all, plenty of old-school platform games to choose from these days. *Douglas Circumstance*'s

sheer quality, however, makes it well worth your attention. A game in what's now called the "Metroidvania" genre, it's a maze-trotting shooter in the vein of the wonderful *Cave Story*, albeit peppered with top-down interludes, exotic weapons and huge, screen-filling bosses.

Douglas Circumstance is from the creators of the very strange indie games *Wyy And Keep* and *Dropsy*, so you can expect the same warped sense of humour as those games; the title monster hunter faces off against a range of maggot infested brains, giant floating heads and killer zombie chefs. One level even appears to pay homage to a scene in *Ghostbusters 2*.

Douglas Circumstance is currently looking for \$25,000 on Kickstarter, following in the footsteps of the superb



▲ A Metroid-style platformer with some truly beautiful graphic designs, *Douglas Circumstance* is looking for funding on Kickstarter now



▲ Riot Games is employing cunning tactics to encourage good behaviour in League Of Legends. Been naughty? No item drops for you

platformer, *Shovel Knight*. Here's hoping *Douglas Circumstance* finds the support it needs. You can find out more about *Shakedown Hawaii* at tinyurl.com/q37tn94, while *Douglas Circumstance*'s Kickstarter page can be found at kck.st/1Ln6xbW.

Online

An online game is only as good as its players, and whether it's looting in *World Of Warcraft* or griefing in *Minecraft*, bad behaviour among users is a common scourge. Riot Games, the developer of the hit MOBA *League Of Legends*, has been trying to curb what it's dubbed "toxic behaviour" among a minority of its players since 2012. Back then, we learned via the website *Polygon* that the studio had employed a team of psychologists to find a way of minimising things like harassment via *League Of Legends'* player chat facility, or general bad behaviour within the game itself.

"We're never going to come to a place where there's no toxicity in *League of Legends*," social systems designer Jeffrey Lin admitted. "We're never

going to get there. But we're finding different strategies [for situations where] if toxic behaviour happens, how do we shield players from it? How do we reduce the frequency of it?"

One of Riot's early solutions was to introduce what it called an Honour System, designed to gently encourage positive behaviour among players. With it, players could praise each other for their loyalty and helpfulness, a process designed to reinforce good behaviour rather than punish the bad. For repeat offenders, the game has the Tribunal system, which uses negative reports to weed out the small percentage of misbehaving players.

Three years on, and Riot's set to add a new means of encouraging users to play nicely. In a 2016 update, the studio will change its loot system, with treasure chests and keys emerging once missions are completed. Inside, players will find a range of random goodies, including free character skins and champions. It's a first for *League Of Legends*, not only because

it hasn't given away free character skins before, but also because it's using these item drops as a deliberate means of encouraging good behaviour. Simply put, if a player's been getting too much negative feedback, they won't get an item drop at the end of a game.

"If you're a player who is punished for toxicity or intentional feeding or so on, you can't get loot," Lin told *Polygon*. "We really want the system to be a reward," Lin said. "It's a new carrot for playing with friends and for being a positive player in the game. We've never been able to give skins for free before in *League of Legends*, so this is our way of saying, 'Hey, if you're a positive player in the game, here's your way of earning something just for playing the game and being awesome.'"

While we'll have to wait and see how the new system goes down with players, it's a clever means of changing the atmosphere of a game without bringing out the dreaded ban hammer. If the update's a success, it's the kind of idea we could see roll out in other games in the future.

Incoming

The *Dragon Quest* series is hitting its 30th anniversary in 2016, but it's still going strong. In fact, hack-and-slash spin-off *Dragon Quest Heroes* should be available on Steam by the time you read this. Developed by Omega Force, it mixes the hectic action of the hit *Dynasty Warriors* franchise with the much-loved characters and world building of Square Enix's RPG series. The result has been a hit with players in Japan already – where it's sold million units already, prompting plans for a sequel.

Dragon Quest Heroes marks the first time the series has arrived on PC and, given that its mix of brawling action and role-playing has gone down well with critics so far, it's well worth checking out. The game's part of Square Enix's new drive to port its games to PC; also out in December is *Lightning Returns: Final Fantasy XIII*, which will come packaged with just about all the DLC and other content the console versions got. Given that *Lightning Returns* finally concludes the *FFXIII* saga, this one's sure to be unmissable for the series' legion fans.



▲ Square Enix and Omega Force's hack-and-slash spin-off *Dragon Quest Heroes* is coming to PC – the first time it's graced the platform in its 30-year history

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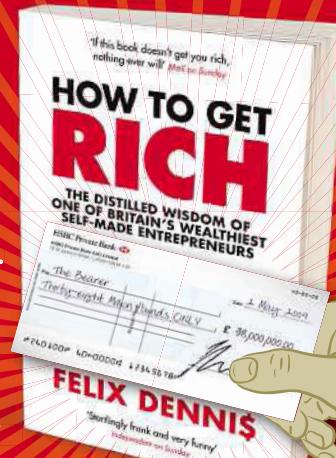
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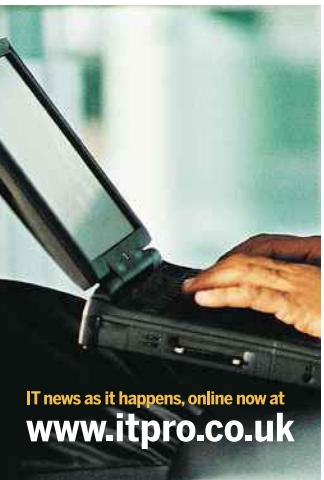
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Please try to keep your queries brief and limit them to just one question per letter, simply so we can squeeze in as many as we can each week. Please include relevant technical information too.

Aaron

Bleep De Bleep

I have a Lenovo Thinkpad, which has worked well for the longest time. Unlike a lot of friends I've had few problems, and I'm always harping on about how good IBM's systems are, while I watch my friends have all sorts of problems with their HPs and Dells. That was, until a few days ago, when I was forced to eat my words.

I came to use my system, but upon turning it on I was greeted with a beeping, followed by an error message. This left my system in an unbootable state, and since then, I've been unable to use my laptop. I can't get past this error, and as my system may be out of warranty (unless I have an extended one, which I have to check), I'm a little lost, and require some help, if at all possible.

When I turn on the system it sounds two short beeps, and then gives me an error code of 02F4. At this point, I can't go any further. All I can do is turn off the system. It does this each and every time I power it up, leaving me with no working computer (I'm emailing you on my phone).

Can you shed some light on this, and possibly provide me with a way to fix it? I'd appreciate any help you can give. I'd also like to know more about these beep codes, as I'm told there are quite a lot, and each pertains to different errors. This would be very useful information to have supplied with a PC, but for some reason, it appears companies don't do this.

Walter

POST (Power On Self Test) beep codes are, indeed, very useful, and when your system has a problem that prevents you from booting up, they can be your only lead to fixing the problem. System manufacturers don't provide this info with systems, but you'll often find all the info



▲ Replacing a laptop motherboard is a little more difficult than a standard PC, so ensure you're up to the task

you need online, if you know where to look, and what to look for.

In this particular case, your error of two short beeps relates to one of many possible POST errors, and this one is 02F4. This error points to a problem with the EISA CMOS, and being not writeable. As per the official service procedure for this code, this can be caused by problems with your BIOS setup and/or a faulty or dead battery. The worst case scenario would mean a replacement of the system board, but this is fairly unlikely.

To attempt a fix, the first step is to enter your BIOS and use the reset option to restore the BIOS to its factory default. This will correct any possible problems relating to BIOS settings. If this doesn't work, the next step is to replace the system battery. This is basically a standard Lithium battery, which you can buy from many outlets, and it's found on the system board. You'll need to consult your documentation for direction on how to find this. Without your exact model, I can't really advise on this.

This should solve the problem in most cases, but if

Beep codes	Diagnostic sequence
One beep and a blank, unreadable, or flashing LCD	1. Reseat the LCD connector 2. LCD assembly 3. External CRT 4. System board
One long and two short beeps, and a blank or unreadable LCD	1. System board 2. LCD assembly 3. DIMM
Two short beeps with error codes	POST error (see next table)
Two short beeps and a blank screen	1. System board 2. DIMM
Three short beeps, pause, three more short beeps, and one short beep	1. DIMM 2. System board
One short beep, pause, three short beeps, pause, three more short beeps, and one short beep	1. DIMM 2. System board
Only a cursor appears	Reinstall the operating system
Four cycles of four short beeps and a blank screen	System board (security chip)
Five short beeps and a blank screen	System board



▲ Lenovo's machines, like many brands, have their own beep and POST error codes

66 The beep codes used by Lenovo machines are a little more vague than many 99

you're very unlucky, the final step would relate to the main system board, which may need to be diagnosed by an engineer, and possibly replaced. If your system is out of warranty, this may be a problem, and it may incur an extra cost from the manufacturer. However, if you do have the extended warranty you mentioned, you may be lucky, and can get it fixed for free. This being the case, I'd recommend you check this ASAP.

You asked for more information about the Lenovo beep codes and errors, and I'm always happy to help when I can, so in the table below is a rundown of the beeps and codes for future reference, for yourself, and other readers who may have problems with their own Lenovo Thinkpads. It's quite the list.

The beep codes used by Lenovo machines are a little more vague than many, and the site lists actions to be performed in order, rather than a simple cause. This is mainly for engineers who can step through the list to diagnose problem components.

Now, brace yourself, as there's a large number of error codes pertaining to the above POST error codes. Again, these are really for engineers, who will step through the recommended sequence, but it can be useful for owners too, to narrow down any possible causes to problems. The list is extensive, far too large to print here, but you can find the full thing at Inv.gy/1QfZ19o.

I should note that the majority of the entries here result in 'System board.'

This doesn't mean that the system's main board is always at fault; it's simply the last option an engineer has, and by replacing or possibly fixing the system board, most faults can be corrected. However, as a home user using this list to diagnose and hopefully fix problems, you'll often find doing such things as reseating hardware, upgrading drivers, resetting the BIOS and so on will usually be suitable. If not, replacing a laptop's system board isn't something for the layman, so if you're not skilled in PC repair, always consult an expert.

If you are confident in your abilities, and wish to try this, it's always worth checking auction sites like eBay if your system is out of warranty, as there's a large market for spare parts online, and you'll likely save money. Just be sure to check the seller feedback, and contact them to double-check the working state of the part. Always try to get anything in writing, just in case you need to seek a refund.

ASK JASON



Meet Jason D'Allison, a veteran of Micro Mart's panel of experts. He's here to help with any technical questions, including anything to do with tablets or smartphones, as well as PCs

Send your questions to:
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Contact Jason by email at:
jason@micromart.co.uk

While we try to cover as many questions as we can, we regret that Jason cannot answer your questions personally, but he'll cover as many as he possibly can each week. Please ask one question per letter and remember to include the full specification of your computer, including its operating system.

Jason

Memory Loss

My motherboard's blown. It's a Gigabyte GA-H55M-S2V, coupled to a Pentium G6950. It's an LGA 1156 job and there aren't many of these available to buy these days, so I'm thinking of moving to LGA 1151, the new Skylake platform, and getting an MSI H110M Pro-VD D3 and a Pentium G4400. Money's very tight, so my plan is to carry everything else over from my current PC. The MSI will take my existing DDR3, but I've read that using DDR3 on LGA 1151 isn't something Intel sanctions and that it could cause damage. Can you clarify this?

Michael, Merseyside

*CPU*s for LGA 1151 have memory controllers that support both DDR4, at 1.2V, and DDR3L, at 1.35V. DDR3L is found mostly in laptops. Standard DDR3, for desktops, operates at 1.5V or 1.65V, and, yes, officially it's out of the picture.

As you've found, though, Mike, many LGA 1151 motherboards break the rules and support standard DDR3 as a headline feature. DDR3 and DDR3L use the same sockets, so it's easy. However, the memory controller in Skylake CPUs is clearly designed for a maximum of 1.35V, so CPU damage would certainly seem a possibility.

Intel has apparently come out and said as much, yet I've been unable to track down a link to an actual statement. Many enthusiasts say it's all FUD – fear, uncertainty, and doubt – and that Intel just wants to drive more sales. But surely

it makes no difference to Intel's bottom line if Skylake users don't opt for DDR4 – the company still sells a new CPU and chipset. I suppose you could argue that it's in Intel's interest to give a leg up to RAM makers, handing them sales on a plate, as it relies on them to adopt and push new technologies.

Anyway, Mike, anyone buying a full PC should just jump in with DDR4. The price premium over DDR3 is only about 25%, and it's dropping all the time. As yet, there isn't a significant performance advantage, but there's no sense in using end-of-line parts when building something new.

In your case, though, your intention is simply to make do and mend. Nowt wrong with that. I'd go for it. I've not read a single report of any problems, but to be fair, damage from over-voltage is likely to occur over time, not overnight. Maybe by Christmas next year we'll be hearing a flurry of complaints from people with fried CPUs...



► Hopefully not needed when using DDR3 with a Skylake CPU...

Quick And Dirty?

Would I get better multi-threaded performance for video and music encoding if I used my Core i7's integrated GPU instead of my dedicated GeForce? I recall a piece you wrote in the early days of Sandy Bridge and the Z68 chipset about some software called Virtu MVP that made this possible. Is this still the case with Intel's newer CPUs? My current system is outlined below, and your reply would help me decide whether I should upgrade.

- CPU: Core i7-2600K
- Motherboard: Asus P8Z77-V
- RAM: 8GB DDR3
- Storage: 240GB SSD; 2 x HDD
- GPU: GeForce GTX 750 Ti
- OS: Windows 7

We're talking about Quick Sync here, the lump of specialised logic often found in the GPUs integrated in Intel's Core CPUs. It arrived with Sandy Bridge (second-generation Core) and continues with today's Skylake (sixth-generation Core). Here's Intel's list of CPUs that support it: goo.gl/qi86HN. Your Core i7-2600K is ready and willing.

As you say, Al, Quick Sync speeds up video encoding – it does nothing for audio encoding, however. This isn't achieved via multi-threading (not directly). Given the same clock speed, it's as fast on a Pentium (dual-core) as it is on a Core i7 (quad-core plus Hyper-Threading). Even a top-dollar dedicated card can't compete, simply because Quick Sync is custom-built for the task and not general-purpose.

The major snag is that normally an integrated GPU gets disabled once something's shoved into the PCIe graphics slot. However, Z-series

AI, Virgin Media

chipsets have a pass-through that allows Quick Sync to continue to function (via the dedicated card's own output). To do this, as you point out, some software is needed: Lucidlogix's Virtu MVP.

Most Z-series motherboards used to come with Virtu MVP in the box – that's the case with your Asus P8Z77-V – but this practice seems to have mostly ceased. Users now typically have to open their wallets to the tune of around \$30 and buy it – if they can find it. All I've found on Lucidlogix's website is a download link for a 30-day trial: goo.gl/dFhjYK.

In Windows 8.x and Windows 10, so I understand, a pass-through for Quick Sync is already included. There's no need for Virtu MVP. I haven't tested this, and of course compatibility is software-dependant – just as it is for Quick Sync itself. I know the popular HandBrake encoder supports this mode of operation. Under Windows 7, it's necessary to pull a bit of a trick, which is outlined in the following thread on AnandTech: goo.gl/l4njKR.

All that's by the by, though. You're all set, Al. You've got everything you need to start using Quick Sync right away. Should you upgrade? Well, Intel's newer GPUs improve Quick Sync only by degrees – it's a bit faster and improves the quality a tad (Quick Sync's output isn't usually quite as good as that produced via a CPU-only method). I really can't think a

wholesale system change would be worth the hassle and expense.

Note – Virtu MVP doesn't work under Windows 10.

▼ Intel's Quick Sync, often accessed via Lucidlogix's Virtu MVP, is largely forgotten, which is a shame



Playing The Name Game

I've recently bought a second-hand laptop. It came with Windows 10, which is fine, but the default user account is called Becky. My name's Philip! Try as I might, I just can't work out how the name can be changed. Surely it must be possible?

Philip Goodwin, Gmail

I've said before that Windows 10's system options seem to be scattered to the four winds. It was the same in Windows 8.x. Some are under the Settings menu and some are in Control Panel. Some are in both! Why on earth doesn't Microsoft just offer the Settings menu and have all the geeky or seldom-needed stuff tucked away under buttons labelled Advanced?

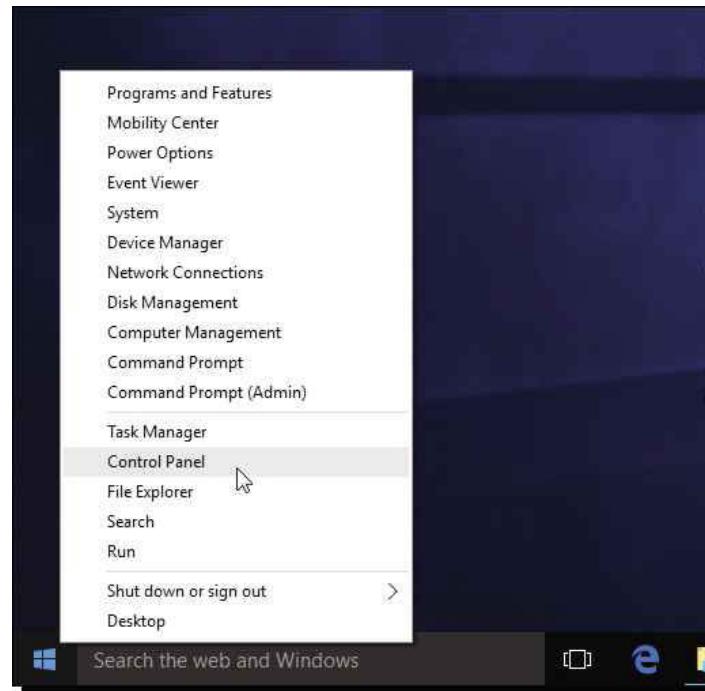
The user-account options are a case in point, Phil. In the Accounts section under the Settings menu – no doubt where you've looked – a name change genuinely isn't possible. There's simply no option for that. Bizarre. To do this, it's necessary to use Control Panel, and there's no link to click in that Accounts section to get there. You have to open it manually, which for the uninitiated isn't as straightforward as it sounds, as Microsoft likes to keep it out of sight of 'ordinary' users. Double bizarre.

The easiest way to access Control Panel is to right-click the Start button and bring up the hidden Quick Access or 'power user' menu (pressing the Windows key and X does the same thing). This exists in Windows 8.x too. On a touch device, you can long-press the Start button and then release.

Windows 10's Control Panel is essentially identical to the one in Windows 7 and 8.x. Just open the User Accounts section and follow your nose. Note, though, that you can only change the name of a

local account – your Becky account sounds local. For users who log in with a Microsoft account (an email address), it's necessary to visit login.live.com and change the name from there.

▼ If you only ever learn one shortcut in Windows 10, make sure it's this one



Crowdfunding Corner

The power of pocket computers is increasingly hard to believe, but if you needed physical proof that your smartphone can do almost anything, this week's pair of crowdfunded projects should definitely provide it

ReadySip

If you're sick of burning your tongue on hot tea or coffee or, worse still, missing the moment when it's at the perfect temperature to drink properly, this might be the project you've been waiting for. This gadget combines a temperature probe, Bluetooth antenna and LED notification so you never have to worry about screwing up your chance for the ideal hot drink ever again.

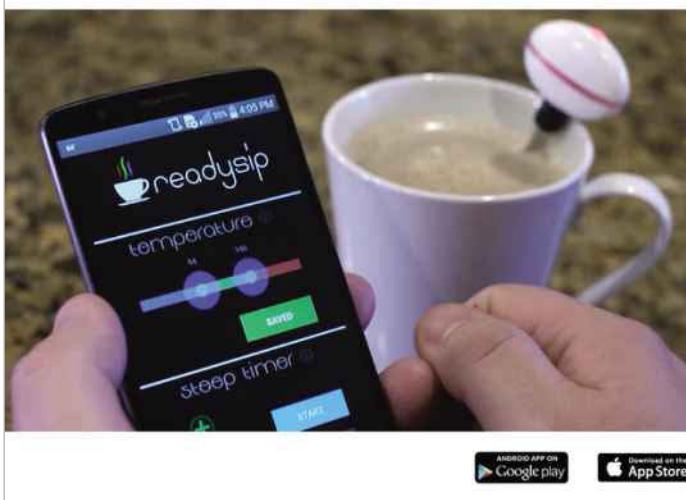
The companion app, available for iOS or Android, allows you to pick the temperature you want to be warned at and check at a glance how hot the drink is. You don't have to keep an eye on it all the time – the LED is keyed to the changes you make on the application, so you'll be able to tell without constant checking when the time is right.

The cheapest way to get one is to pay \$20, which is an early bird special at \$10 less than retail price. UK backers can expect to pay around £13, so it shouldn't break the bank – and even if you miss the early deals and have to pay full price (\$30 / £20), you'll get a free coaster and stickers thrown in with it. If it meets its target, you can expect to see it in May 2016.

URL: kck.st/1PvuxBM

Funding Ends: Saturday, 16th January 2015

mobile apps



Lumu Power

If you're a photographer, you'll know that light meters are essential but expensive pieces of kit to buy – and while there are apps that claim to do the job for you, the hardware in a phone simply isn't up to the job.

The Lumu Power can change that. This detachable sensor fits into a standard 3.5mm jack and contains both a true colour sensor, to help you calculate temperature, white balance and illuminance, and a fast silicon photo diode for setting the exposure based on ambient and flash light. All you have to do is plug it in, launch the app and begin testing. You'll automatically get the figures you need to make your photos perfect.

Early bird tiers have unfortunately gone, but you can still get a Lumu Power pack for \$199, which is \$100 off the retail price. In UK money that's just £133, which is about the price of a decent light meter anyway, only with the added bonus that this one takes up almost no room.

The project has already reached more than 200% of its original funding target, so it's safe to say it's getting made. Devices will ship in June 2016, so the wait isn't too long either.

URL: kck.st/1SwCqof

Funding Ends: Wednesday, 30th December 2015



Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!

App Of The Week

Dream:On

David Hayward shares his dreams with us this week

I had a really odd dream last night. Odd and a little disturbing. There I was, at home, when giant birds started attacking. I felt a little panicked, as you would, so I leapt out of my window and had to fly higher than the birds to get away, but I couldn't, no matter how hard I tried.

It was one of those flying dreams, where you can only fly if you swim through the air and for some reason you can never get higher than the roof of your house, but it did make for an amusing topic of conversation the next day, with the question 'What if you could influence your dreams externally?' The words, 'there's an app for that' rang out loud and clear.

Dream:On

Dream:On is an app for iOS devices that has been designed to help you have the dream you want – or at least try to influence your dreams through the app itself as a mass participation experiment.

Created with the help of psychologist Professor Richard Wiseman, Dream:On works by tapping into your dream state patterns when you're fully zonked out,

which 'they' think is roughly 20 minutes before you wake up or when you finally stop shifting around.

To use it, simply download the app and before you go to bed tap on the 'Start Dreaming' button, then enter the time you want to wake up followed by an alarm tone. Finally, choose one of the available SoundScapes. After that, you'll need to plug in your iPhone and tap the 'Start' button, then place the iPhone face down next to you in bed.

Throughout the night, the app will monitor and log your movements, then around 20 minutes before you wake up and when you're especially still, which is an indication that you're dreaming, it will then start to play your chosen SoundScape, which in theory will give you a pleasing dream based on what the SoundScape is about, through the sound affecting your subconscious.

When you start to move around again, the app will lower the volume of the SoundScape, wake you up, then prompt you to fill in a brief report on your dream and the possible effect that Dream:On may have had for you. Also, you can post your dream on Twitter, or if any of

Features At A Glance

- Free.
- Smart alarm and nice alarm sounds.
- Sleep monitor and dream graphs available.
- Take part in a cool experiment.

your friends appeared in your dream, you can tag them and send it off on to Facebook.

After a set period of a few months, the team behind Dream:On will analyse the data and see if it really is possible to influence your dreams through external sources and, in particular, this app.

I Had A Dream...

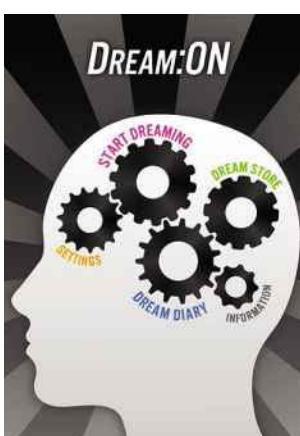
Does it work? Well, according to the initial results of the first trial, which ended last year, the data shows that people's dreams are influenced by which soundscape they choose. More information can be found on the Dream:On website at dreamonapp.com.

Believe what you may, in terms of being able to influence your dreams, but one thing is for certain regarding Dream:On: the alarm calls are very nice indeed – tranquil and quite mellow, but enough to wake you up without jarring you out of the arms of old Morpheus.

Conclusion

Personally, any dream is better than the one I had to begin with. After trying the app for a couple of weeks, I can honestly say that I can't actually remember any of the dreams I had in that time, which is a bit of a shame.

However, I did feel more relaxed after waking up. So maybe, somewhere in my subconscious, the Dream:On app worked its magic and I was left basking in a peaceful garden – free of giant birds.



▲ Pick your dream or enter in your Dream Diary

► Dream:On: the dreaming app for iPhone

Logging Off

For anyone who threw caution to the wind, and installed Windows 10, things have been a bit weird recently in regards to updates. The much heralded November Update appeared, some weeks after the same code was pushed into Insiders in October. And then just as quickly it was gone, with zero explanation as to why it had left the stage.

Having confused everyone, now it's back and with a story that just didn't ring true, for a number of good reasons. Yet it did at

least convey that something had happened this time.

According to Microsoft, "Once these customers installed the November update, a few of their settings preferences may have inadvertently not been retained."

These settings were the exact ones related to privacy choices, like allowing for an advertising ID and others. Strange.

But what really got people scratching their heads was this part of the statement: "For these customers, we will restore their settings over the coming days and we apologize for the inconvenience."

Eh? So what it's saying is that if you disable these settings to protect your privacy, Microsoft stores those changes on the cloud. Why? I ask this because I haven't noticed that they ever replicate to any other installation automatically.

If that wasn't odd suspicious enough, other things it's done recently on the subject of privacy require greater scrutiny. Earlier in the year, both Windows 8.1 and Windows 10 got a patch (KB3022345) that added a service called DiagTrack

(Diagnostics Tracking Service). It soon became aware that this was a less than friendly spyware tool devised by Microsoft to grab your name; email address; preferences and interests; browsing, search and file history; and phone call and SMS data, and send it to them. Nice.

After a number of vocal complaints, it was removed. Or rather that's what people thought, but it wasn't gone for good. No, in the sort of software slight-of-hand that only Microsoft can do, it renamed the service to 'Connected User Experiences and Telemetry Service'. You can disable this service if you know how to do that manually, but I'm sure it will return called something else again in the next patch release.

In an interview that Windows honcho Terry Myerson gave in September, he was directly asked about the information Microsoft collects and said, "Windows 10 collects information so the product

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will work better for you," and "you are in control with the ability to determine what information is collected."

Is that really true, Terry? That appears to be high-quality BS you're peddling there, judging from these two examples alone. It seems likely there are also ones we don't know about yet.

I'd also like to point out that when the .iso of the latest version of Windows 10 became available again, I checked it against the one Microsoft pulled, and there isn't a single byte different. It's simply added a patch now to put back the settings from its chest of purloined data, where everything about its customers resides.

The thinking inside this company appears to be that since it gave us a free OS, possibly, then we should at least let it take all our information in return.

It's a wild guess, but as it's never voiced this position publicly, I can see this attitude returning to bite it hard eventually.

Mark Pickavance

LAST WEEK'S CROSSWORD

Across: 7 Transcriptome, 8 Untrue, 9 Elicit, 10 Isopach, 12 Penny, 14 Dolby, 16 Preview, 19 Operon, 20 Pyrope, 22 Autoradiogram.

Down: 1 Iran, 2 Entrap, 3 Science, 4 Fixer, 5 Strike, 6 Ambience, 11 Scorpius, 13 Cryptic, 15 Borrow, 17 Virago, 18 Annal, 21 Peak.

DISCLAIMER

The views expressed by contributors are not necessarily those of the publishers. Every care is taken to ensure that the contents of the magazine are accurate but the publishers cannot accept responsibility for errors. While reasonable care is taken when accepting advertisements, the publishers cannot accept any responsibility for any resulting unsatisfactory transactions. This week, we had to buy some plastic toy building blocks for someone. We won't say which brand of plastic toy building blocks they were, but it rhymes with 'meggo'. Anyway, we haven't bought any of this stuff for quite some time, so we had no idea how much it would cost. As it turns out, we were pleasantly surprised... Ha ha. No,

not really. In fact, we very nearly fainted when we saw the price of these plastic toy building blocks, which, let's not forget, are toy blocks for building that are made out of plastic. But it was someone's birthday, so £60 was handed over to a no doubt delighted toy retailer, and in return we received a box of plastic toy building blocks. Yes, we could have bought a decent tablet for that price or even spent the cash on a week's worth of grocery shopping (minus all the fun things like cake and ice cream), but plastic toy building blocks it was. Nevertheless, what really matters is that we built ourselves a little car, and at no point did we feel bitter about the fact we had to spend 60 quid on a boxful of... well, you get the idea.

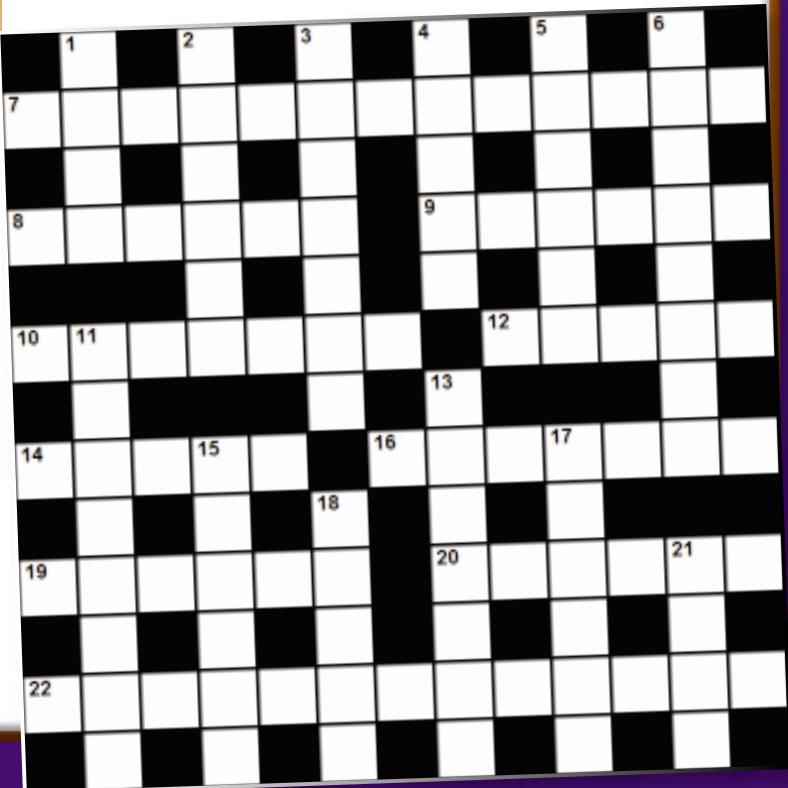
THIS WEEK'S CROSSWORD

Across

7 Born in 1911, the pioneering CEO of Control Data Corporation, at one time one of the most powerful and respected computer companies in the world. (7,6)
8 German philosopher who argued that philosophical authoritarianism is inevitably oppressive and that all theories should be rejected. (6)
9 Mental images and emotions occurring during sleep. (6)
10 A character used in printing to indicate a cross reference or footnote. (7)
12 What goes on in there stays in there! (5)
14 A gesture used in iOS. Made by moving the finger swiftly in any direction. (5)
16 An event such as a date or a sequence of keystrokes programmed into some malware to initiate activation. (7)
19 A worldwide system of internet-based discussion groups. (6)
20 Heavy duty cross-platform RDBMS. (6)
22 The study of fluids in motion. (13)

Down

1 In computing to associate an identifier with a value or object. (4)
2 Grammatical number category referring to two or more items or units. (6)
3 Leave suddenly. (7)
4 A positively charged electrode by which electrons leave an electrical device. (5)
5 .gr TLD. (6)
6 Updateable program code stored within hardware that determines how it works. (8)
11 The centre of a target. (8)
13 A US DOE National Laboratory near Chicago, Illinois. (7)
15 A small wing-like projection attached to an aircraft forward of the main wing to provide extra stability or control. (6)
17 A metric unit of mass equal to one thousandth of a kilogram. (6)
18 The devotion of time and attention to gaining knowledge of an academic subject, especially by means of books. (5)
21 Feature on iOS devices used to fix the display in either vertical or landscape orientation. (4)



In Next Week's Micro Mart*

- Security special! How to stay safe, anonymous and informed online
- The very best of the Windows app store
- How to 'upcycle' your old equipment
- Plus the usual mix of news, reviews and advice



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NITRO Features



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